ELECTRICAL REVIEW

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9 APRIL 1954

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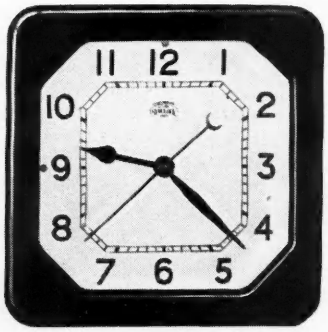
Timers and Timing



4″ or 6″ Square Flush Synclock Electric clock with centre second hand.

Industrial models up to 4 ft. square also available.

Cat. Sheet 635A.

Precision Synclock Time Interval Meter for measuring time intervals from 1/20th second to 10 seconds.

Synclock "Miniature" Self-Starting Synchronous Motors. High-Torque. Low power consumption.
Models for all power frequencies and for all voltages between 4 and 400 volts.
Wide range of speeds.
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Industrial Synclock Time Interval Meter.
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Manual or electrical reset models available.
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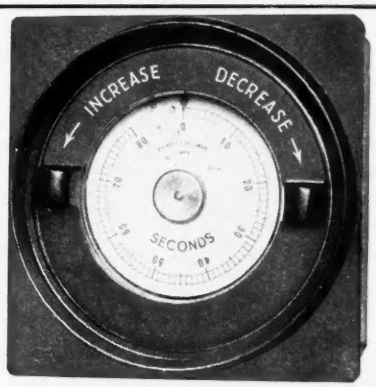
Based on the Synclock self-starting miniature synchronous motor, Everett Edgcumbe have developed, over the past 27 years, many types of useful timing equipment, for process control and related duties.

The Master Frequency Meter, used in Power Stations all over the world is a fundamental instrument for the control of mains frequency, on which all mains driven timing devices depend. Many special arrangements of repeating or single purpose timers have been made and 'Synclock' motors will be found in very many types of process control devices.



Varicon Process Timer, mains operated. External adjustment of time interval, unelapsed time always visible. Ranges from 5 seconds to 20 hours available.
Cat. Sheet 611A.

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Designers and manufacturers of almost every type of electrical indicating and recording instrument.
Specialists in: Speed Recording, Photometry, Process Time Control, Telemetering.

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ELECTRICAL REVIEW

9 April 1954 Vol. 154 No. 15 Established 1872

Economic Survey

GENERAL satisfaction has been expressed with the Government's *Economic Survey for 1954* (Cmd. 9108, H.M. Stationery Office, 1s 6d) and regarding the document as a picture of the immediate position this gratification is not unwarranted. By the end of last year industrial production generally had risen by 6 per cent above the 1952 level, the gold reserves were increased and there was an improvement in the sterling-dollar situation. The "trade gap" was lessened and larger "invisible" exports again produced a large surplus in our current balance of payments account, though smaller than in 1952. The result was largely attributable to an improvement in the terms of trade; import prices during the year were about 12 per cent lower while export prices fell by only 3 per cent. The *Survey* points out that these terms of trade cannot be expected to remain so favourable.

What of the electrical industry's contribution? It is shown in an appendix that the output of steam turbo-alternators and turbines continued to rise (from 2,395 MW to 2,718 MW). During 1953 a total of 1,428 MW was commissioned by the British Electricity Authority, slightly less than in the previous year but 200 MW more than in 1951. The output of electric motors rose in value from £42·9 million to £43·5 million (in 1951 the value was £36·9 million). Insulated wire and cable production was lower in value than in 1952 (£107 million against £119·6 million) but still well above the 1951 level (£92·8 million). Although the value of direct electrical exports as a whole was lower than in 1952 the industry made the valuable contribution of about £176 million.

It is made evident in the *Survey* that the country's present comparatively prosperous condition can be maintained only by hard work and attention to overseas customers' needs. A warning is uttered that the course of world trade will depend largely on what happens to industrial production in the United States and Western Europe. So far the moderate "recession" in the United States has brought no violent change and the American Government has preparations for meeting any cumulative downward movement.

Competition from the resurgent German industry has to be met, even though a continued rise in international trade may lessen its immediate effects. It is pointed out that we are still not selling enough abroad both to sustain a higher standard of living and meet our external commitments. A rise in internal costs would disastrously weaken our competitive power and postpone any chances of further improvements in our standard of living. This must happen if rises in wages, salaries and profits regularly outstrip increases in productivity.

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POWER STATION EFFICIENCIES

The improvement once again in the average thermal efficiency of the public supply steam power stations throughout the country is an indication of a certain "getting into stride" again after the wartime and post-war years. Part of this advance is accounted for by an improvement in the fuels available, but what is no doubt of greater importance, improved operation technique, has also contributed to the better position. The table for 1953 is given elsewhere in this issue. The advance of 0·6 per cent in the general (average) position for 300 stations and an average efficiency of over 28 per cent for the twenty stations with the highest efficiencies are very encouraging. The greater importance of the improvement lies in the general figure, of course, but some of the individual results are most interesting. It is not surprising that the winner last year, Littlebrook "B" (29·68 per cent), has given place to the Portobello H.P. station with its high pressure steaming (30·86 per cent). Littlebrook "B" now occupies fourth place and as this is a base-load station it is interesting to compare it with Littlebrook "C" (27·65 per cent), a new station which did not have a full year's run and which is designed for maximum flexibility between base-load and two-shift operation.

ELECTRICAL TECHNICIANS

One theme, expressed or implied, was common to the speeches at the dinner of the Association of Supervising Electrical Engineers, reported in this issue. That theme provided the basis of the presidential address of Mr. C. T. Melling (*Electrical Review*, 30th October, 1953) and was further emphasized by Mr. H. Bishop, President of the Institution of Electrical Engineers, on the present occasion. It concerned the urgency of the need for many more well trained electrical technicians, whose special qualifications have come to be more clearly appreciated in recent years. While sound technical knowledge is a prerequisite, as well as personal initiative within their sphere and ability to direct the work of craftsmen, it is not essential that they should possess the more advanced technological attainments of the smaller "professional" group. Something different from the I.E.E. examination is therefore required to indicate proficiency and the Association has undertaken to devise appropriate measures with the sympathetic aid of the Institution.

ENGINEERING WAGES

After many months of discussion, during which a one-day strike occurred and threats of a ban upon overtime and piecework were made, a settlement has been reached on the question of wages in the engineering industry. The trade unions' original claim was for a 15 per cent increase. A Court of Inquiry set up by the Minister of Labour to investigate the position recommended a 5 per cent increase as a basis for negotiations. Although the employers still contended that no increase could be justified they offered to raise wages by 5 per cent but the unions declined to accept this and asked for a further meeting. Still maintaining that they could go no farther unless the unions produced valid arguments in favour of their claim, the employers nevertheless conceded a little more—actually about 6 per cent. By this means the dislocation which refusal to work overtime or on piece rates would have caused has been avoided. It can only be hoped that with the increase now awarded there will be a long period of stability accompanied by steady output. Otherwise the substantial addition to costs will not be offset and export prices will be increased at a time when the imperative need is for reduction.

THE ELECTRICAL IDEA

In view of the domestic electrification campaign recently launched by the Electrical Development Association it was appropriate that the papers at the opening sessions of this week's conference should be particularly concerned with this aspect. Mr. J. Gogan set the pace by calling on those in the industry to "sell the electrical idea by their example." He pointed out that at present only about half of the employees used electricity for cooking in their homes and that if the remaining 50 per cent did so as well the industry would gain a worth-while load and a valuable propaganda point. Sales staffs should have personal knowledge of the appliances they sold and facilities should be available for them to have the latest equipment in their homes free or at a low rental. Enthusiasm is infectious and clearly sales men and women who are themselves convinced of the superiority of electrical methods will have an incalculable influence in spreading the doctrine of the "all electric" home.

SUPPLY SYSTEM ANALYSING

The use of network analysers for the study of electrical power system problems is now well established and most major systems and extensions of systems are planned nowadays with the use of analysers of one form or another. There are basically two main kinds, the impedance type, an example of which is described in this issue, in which the impedances of the power system are represented by impedances in the analyser; and the analogue type in which the impedances are represented, for example, by transformers, as in the Blackburn analyser. Power system studies may also be made by setting up the equations of the system and solving these on one of the many forms of digital computer.

STEEL PRODUCTION

We make no apology for returning so soon to the subject of the Battelle Report recently published in the United States. The essential point in this Report is the possibility of the production of the ordinary grades of steel in future by the electrode arc furnace; this work should no longer be left to the open hearth furnace. We have not the facilities at hand to form a ready estimate of what the present production of normal grade steel would represent in terms of electricity consumption, to say nothing of the electrical equipment required, but obviously the figure must be very great indeed, so great that the electrical industry in this country cannot afford to let this tremendous potential development slip into the background.

ELECTRICAL FILMS

A Potent Educational Medium

By T. B. SANSOM

THE possibilities of sub-standard films are not always fully appreciated and it is the purpose of this article to bring out some of the more important aspects of their use. The major electrical companies and associations have all produced 16 mm films and a list is appended to this article of the films available for showing to all audiences interested in electrical matters. Films of the type catalogued may cost anything from £2,000 to £10,000 to make but although a great many of them are available free of charge they are not always used as fully as they might be.

First, however, we will consider the use of films within the industry, i.e., films that are made for one type of audience only. It will probably be simpler to divide the users into two types and the following division is suggested:

(A) Films made by a company for public showing and intended for the following purposes:—

(1) Publicity.
(2) Training in colleges and other technical institutions.

(B) Films made by a company for its own specific use and not intended for commercial distribution:—

(1) Training workers for a specific job.
(2) Time and motion study.

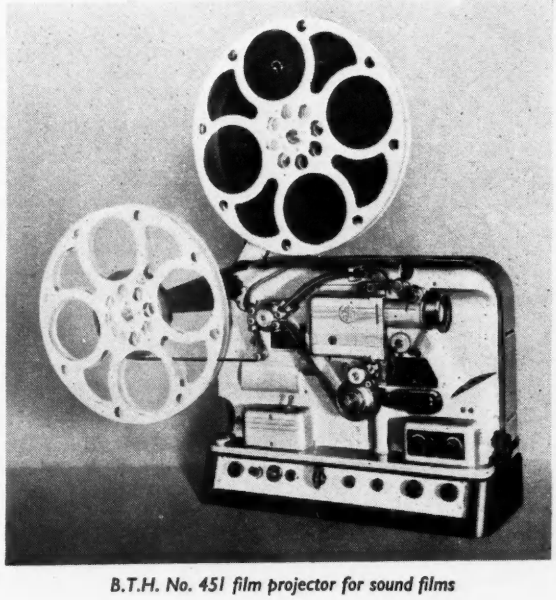
Although under heading (A) films are available from the building and operation of a complete hydro-electric scheme down to "shorts" illustrating the principles of magnetism and electricity, the potentialities are by no means fully realized. Of the two uses listed under (A) probably the second is the more neglected. This is most unfortunate for a film correctly made and applied can do more than any half-hour lecture on one of the numerous electrical subjects available to the student.

The film must, however, be used with discretion and inserted in the right place in the course. For example, it is of little use starting off the session with a film on the elements of magnetism if the students have not met the subject previously; it is equally foolish to present a film right at the end of the year on some subject not directly connected with the work. It merely becomes a "filler" and is not taken seriously. Too few colleges take the trouble to use films as a definite part of the syllabus and plan the session accordingly. In a course of fifteen lectures four carefully chosen films could do much to stimulate interest and help the student who cannot always grasp things at a first hearing.

For a first-year class taking the Ordinary National Certificate course in electrical engineering the author would recommend something on the following lines:— After three or four lectures have been devoted to magnetism and electricity the film "Magnetism" could usefully be shown. The students will know sufficient of the subject to be able to appreciate the subject matter and it will do more to assist their recollection of the previous lectures than any hour spent "summing up" can do.

The following films could be used in a similar manner, each being shown at the conclusion of a section. The films indicated are a good example of visual aids for a first-year electrical engineering course:—"Principles of Electricity," "Electricity and Heat," "A.C. and D.C.," and "Electricity and Movement."

The more advanced courses may be conducted on similar lines, the important point being to plan them with a view to using visual aids and to select carefully the films that best suit the syllabus. It is also essential for the lecturer to see the films before exhibiting them to the class. Titles can be misleading and there is nothing worse than to show a film that lays stress on the wrong points or deals with the subject in a manner too advanced for the group concerned.



B.T.H. No. 451 film projector for sound films

It is fitting at this stage to mention the recent advances of sound on tape. Magnetic recording has now been applied to film and one can make one's own films and add the sound track after processing. A thin magnetic coating is applied to the edge of the film and the projector is used both for recording and "playback." This latest development lends itself more to the ends of education than anything else. The lecturer for the first time has the opportunity to record his own comments to the films; he

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also has the facilities to record his own commentary and re-recording on the one film as many times as he wishes. The field that this development opens up is tremendous.

For those who are interested illustrations are reproduced of two types of projector for optically and magnetically recorded sound films, the B.T.H. No. 451 machine and the G. B.-Bell & Howell Model 630.

Entertainment and Instruction

Publicity in the electrical industry forms a very important function in the commercial organization and many of the larger firms have produced films for assisting sales. British Insulated Callender's Cables, Ltd., has produced numerous first class 16 mm films in both colour and black and white illustrating the uses of its products.

Notwithstanding the fact that films made for publicity purposes are usually shown to audiences of adult years in the form of technical entertainment, planning and choice of film are just as important as in the latter case. For example, the B.I.C.C. film " Prelude to Power," a sound film in colour running for 40 minutes portraying the building of a dam and hydro-electric station at Castelo do Bode, Portugal, is ideally suited to back up a technical lecture on hydro-electric power. It has been made as a technical entertainment film and shows the erection of the 150 kV transmission line. It also records the construction from the preliminaries to the completion of the head-works and erection of the transmission line.

On the other hand, it would be of little use showing the B.I.C.C. film " Jointing 66 kV Oil-Filled Cable " to the type of audience visualized above as this film is devoted entirely to the correct method of jointing a cable and has little entertainment value; it is in fact a film ideally suited for instructional purposes with a class for cable jointers.

For a publicity film to make an impression it must have a certain degree of entertainment value and the subject must be selected with care. In many cases the people responsible for selecting film programmes have not investigated the field open to them as thoroughly as they might have done, or have not seen a sufficient number of the films available to appreciate the need for an intelligent choice. In the majority of cases the inquirers merely write to the Central Film Library or the companies concerned for a programme of films on some subject. The films come forward and are very seldom screened beforehand with the result that until they are shown publicly those responsible are never sure whether or not they have the right film for their audience until it is too late to do anything about it.

The electrical engineering profession will never be able to appreciate the value of the 16 mm film to its fullest extent until those who select and show films take more trouble and pains over the matter.

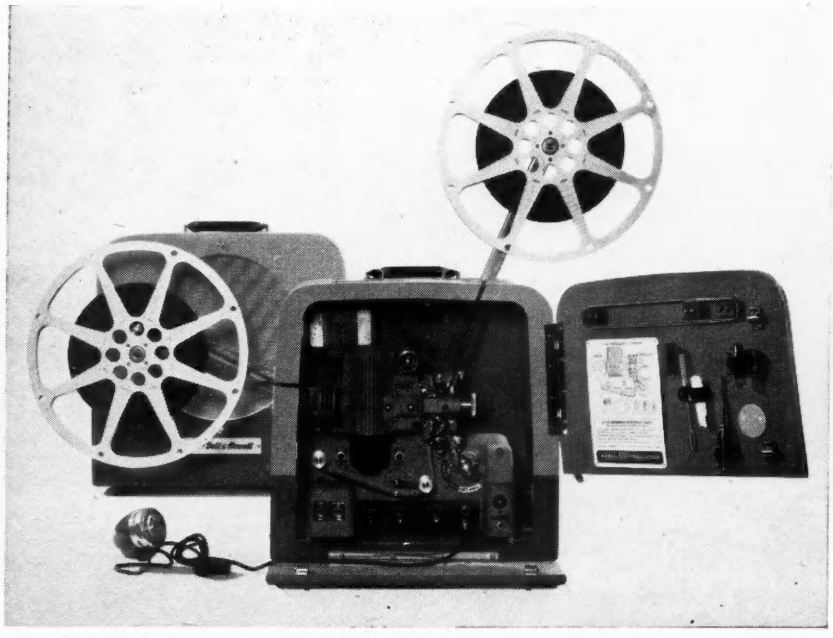
Hints on Presentation

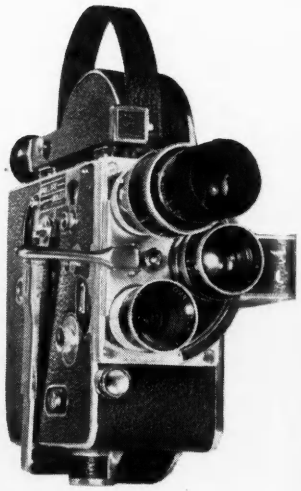
Presentation is one of the most important aspects of the use of all sub-standard films, as for the most part the films have to be screened outside a professional theatre, in halls, lecture rooms, and even in the open air, by means of back projection. Halls and lecture rooms will, however, be our main consideration.

Let me say at the start that this aspect of the job in the majority of cases leaves a lot to be desired and is the reason for its inclusion in this article. Every effort must be made to avoid such mishaps as film breaks, lamp failures and sound failures. Films often appear on the screen upside-down and frequently the speech is unintelligible. The latter is not always due to a poor sound track; in many instances it is because insufficient care has been given to the placing of the speaker. To insure against such short-comings the following precautions should be taken.

(1) Never employ an operator who has not first of all been trained as an electrician and obtained a tradesman's certificate. Make sure that the firm is one of a reputable nature for there are many organizations on the market who use this type of business as a money-making "racket." Their equipment is obsolete and the operators are both unskilled and uninterested.

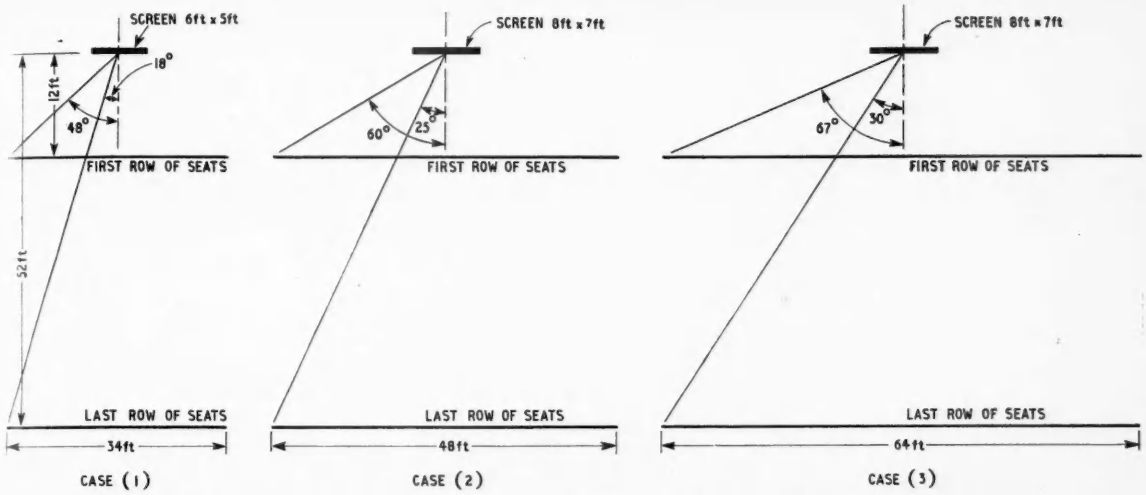
(2) Before any films are shown they must be examined for condition, breaks and poor splices and also to ascertain that they have been rewound after leaving the last user. Many film makers employ professional distributors to examine and check each film before it is sent out. Although many projectionists believe blindly in this service, it is not infallible as I have found from experience.





Paillard-Bolex H-16 cine camera

G. B.-Bell & Howell Model 630 optical and magnetic projector is shown on the left



Arrangement of screen and seating in relation to dimensions of hall: Case 1—Glass beaded screen; maximum viewing angle 48 deg. Case 2—Silver screen; maximum viewing angle 60 deg. Case 3—Matt white surface; intensity of illumination constant irrespective of angle; minimum projector lamp wattage, 1,000

(3) Screen at least a portion of each film before the actual performance to check the quality of the sound track and the acoustics of the hall. Remember the hall you are showing in was probably not built for showing sound films. Further, if the track happens to be poorly recorded there is always the possibility of obtaining a replacement copy before the actual performance.

The usual recommendation is that the speaker should be mounted at a point two-thirds of the height of the screen but I have found that an alternative position sometimes gives better results, and any worthwhile operator will experiment to find this.

(4) Finally there is the question of screen illumination. It is useless to go to the trouble of obtaining a high-powered projector and then use any screen. The light loss in a projector is high, due mainly to the shutter. Some improvement can be obtained by risking flicker but this is not advisable. Three types of screen are available, i.e. glass beaded, silver and plain white. All have their limitations and it is as well to know these before accepting one or the other. The glass beaded screen gives by far the brightest picture so long as the audience is directly facing it, the reflection factor being high. It is, however, also very directional and although a person sitting directly in front of the screen may see a well illuminated picture anyone placed at 45 deg to the screen will view a different set of conditions altogether; the picture may appear quite dim by comparison. If the room is long and narrow then the glass beaded screen is the thing as the majority of the audience will be viewing the screen direct on.

The silver screen whilst it does not possess directional properties to the same extent as the glass beaded type is not so highly reflective. It can therefore be used more freely and, providing the picture is restricted to something not exceeding 7ft by 6ft with a 750 W lamp, the results to all viewers will be quite acceptable.

The matt white screen gives a uniform degree of brightness at no matter what angle it is viewed, but its picture compares unfavourably with the other two surfaces when viewed direct on. Its use should be restricted to rooms

DETAILS OF PROJECTORS (SOUND-ON-FILM AND SILENT) PRODUCED SINCE 1945

Make of Projector	Suitable or can be made suitable for Magnetic Stripe	Approximate Purchase Price		Audience that can be catered for (approx.)
		S.O.F.	S.O.F. and Stripe	
Bell & Howell 621	No	£264	—	500–750
„ „ „ 630	S.O.F. and magnetic	—	£350	500–750
Ampro " Stylist "	Not at present	£192	—	300–500
„ " Major "	Not at present	£265	—	500–750
B.T.H. 401	Not at present	£235	—	500–750
„ 451	S.O.F. and magnetic	—	£350	500–750
Victor	S.O.F. and magnetic	—	£295	500
Ernson 540	No	£165	—	300–500
Carpenter	No	£240	—	500
De Brie D16	Yes	£276	—	500–750
Dicnos	No	£175	—	500

which are small and square and the picture size limited to 6ft by 5ft when a 750 W lamp is used.

It is not easy for one unaccustomed to the use of this equipment to detect the different surfaces at a glance and the price of a glass beaded screen is much greater than a silver or plain white surface. Many firms are quite content to use the cheapest white screen available, feeling they are well covered by the audience's ignorance on this subject.

It will be appreciated that many of the remarks already made will apply to the headings listed under (B) and it is therefore only necessary to comment on the essentials that are particular to this consideration. The main difference in the following is that the films will be made in order to satisfy one particular object and the type of audience can be catered for at the outset.

Initiation of people into a new job presents difficulties in even the best organized industries. Before the application of the 16 mm film the only way to deal with this problem was through personal contact with established employees and a conducted tour of the works which, besides taking a great deal of time, was seldom satisfactory because of the noise of machinery and because the new arrivals were far more interested in the immediate surroundings than in the processes of manufacture. Numbers also play a part; if only one new employee is involved, the time taken is wasted and if the number exceeds five, it is difficult to give each one the attention he may require.

There is also a direct aid to production under this heading. It has been established that for an operator working on mass production methods to give his best he must be familiar with all the other processes that go to make the final product. Without this knowledge he has not the slightest idea of how a stoppage in his effort or department may affect another part of the plant and hence his co-workers, some distance removed from his own shop.

What better method is there than showing a film of the complete process linked up with the individual departments? I would go so far as to say that the film is the only practical method of achieving the desired results.

Motion study was possibly the earliest application of cine-photography to industry; it originated in America in an effort to increase production figures. These methods have never enjoyed the same popularity here as in the United States; many authorities give the reason that our industries are not run on the same lines and do not therefore lend themselves so readily. It is my experience that although this may be true to some extent, it is not the only reason.

Theoretically speaking, there is no better way of showing an operator his mistakes, introducing a new method, or improving upon an old system of production than to make a film record and to show it to employees before initiation. If the film is a short one, bringing out mistakes in an operation, it may be run through the projector in the form of a loop and so repeated as many times as required.

Such films must be made with careful preparation without interfering in any way with normal production; the minimum of lighting must be used and the exposure should be known beforehand so that the film can be taken with as little delay as possible. The secret lies in being efficient, quick and working with the minimum of equipment. It is also advisable to let all workers know in a general manner what is being undertaken. One of the best-suited cameras for this work is the 16 mm Bolex H-16. It is light to handle and very compact, making for accurate and speedy work.

A LIST OF FILMS AVAILABLE

Title of Film	Sponsors	Brief Description	Running Time (minutes)
The Generation of Electricity	British Electrical Development Association	Water and steam power development	10
The Transmission of Electricity	"	The conveying of electricity through transformer stations and the grid to the point of use	10
Simple Electrical Repairs at Home	"	Fuses, plugs and meters explained	10
The Electric Iron	"	Construction and heat-control mechanism	10
The Electric Cleaner	"	Method of operation and use	10
The Refrigerator	"	Explanation of principles and examples	10
The Electric Cooker	"	Construction, control and use	10
The Electrical Circuit of the House	"	Follows the wiring from the mains to various appliances	10
Domestic Hot Water	"	Arrangements for ensuring an adequate supply	15
What is Electricity?	"	Development and application of theory of electric current	13
Magnetism	"	Atomic or molecular theory of magnetism explained	14
Electricity and Light	"	Filament, arc and fluorescent lamps	18
Electricity and Movement	"	Permanent and electro-magnets and the simple motor	11
Electricity and Heat	"	Explains good and bad conductors and " resistors "	8
High-Frequency Heating	"	Uses in industry and medicine	9
Putting Free Electrons to Work	"	Operation and application of electronic valves	9
Electro-Chemistry	"	Shows how ions are influenced by electric currents	19
A.C. and D.C.	"	Defines the difference and explains their particular uses	10
Electrical Terms	"	The significance of the volt, ampere, ohm and watt explained	17
Out of the Dark	"	Development of artificial light and its influence on social history, discussed by Dr. Bryant and Prof. Andrade	27
Ammeters and Voltmeters	"	Explains the operation of measuring instruments	12
Electrical Induction and Capacity (in three parts)	"		
1. *Capacitors*		Construction and operation of the condenser	14
2. *Inductors*		Electro-magnetic fields and their effects	6
3. *Effects on A.C. and Power Factor*		Induction and capacity in action	8
Prelude to Prosperity	"	Electric power in industry	50
		(Short version)	30
Can We Be Rich?	"	" Prosperity " discussed by Geoffrey Crowther	25
A Place in the Sun	"	Lord Beveridge discusses housing in relation to places of work	35
Men of Merit	"	Explains by cartoon and puppetry the " peak period " problem	5
A Case for Handling	"	Materials handling in industry	32
Power on the Farmstead	"	Explains the induction motor, and illustrates its uses on the farm	14

Title of Film	Sponsors	Brief Description	Running Time (minutes)
The Line to Take	British Electrical Development Association	Single-phase and three-phase supply in power applications	12
Electric Water Heating	"	Guide to practical design and installation	28
Distribution of Electricity	"	Traces the path of supply from grid to consumer	10
50 Acres	"	How a small farm was electrically equipped	25
Clean Milk Production with Electricity	"	A dairy film	28
Cooking for the Million	"	Large-scale cooking in schools, restaurants, etc.	20
Boiling and Simmering	"	Demonstration by Philip Harben	19
Proof of the Pudding	"	Dramatized demonstration of electric cookery	9
'Twas on a Monday Morning	"	Compares old-fashioned and modern laundry methods	20
The Good Old Days	"	The humour of pre-electric times	20
Hot Evidence	"	Water heating in the home	17
The Wizard in the Wall	"	For younger children. A " fairy tale " of electrical discoveries	15
Kitchen Planning	"	Contrasts unplanned kitchens with modern layouts	15–20
Electric Cooking	"	Demonstration by Marguerite Patten	25–30
A Glimpse of Metro-Vick	Metropolitan-Vickers Electrical Co.	Activities at the Trafford Park works	32
Heart of the Trolley Bus	"	History of street traction development	36
The Development of the Gas Turbine	"	Working principles and applications	20
Research in Engineering	"	Fundamental investigations, application to problems and material-quality control	42
Planned Electrification	"	Electrification of a Lancashire colliery	34
Radar Goes to Sea	"	Radar as an aid to marine and air navigation	28
Radar Record	"	Depicting the radar screen during a steamship's run	10
Power Plant by Road to Site	"	Movement of a large generator stator from Manchester to Littlebrook	11
The Electron Microscope	"	Construction and use, illustrated by micrographs	18
Electric Induction Heating	"	Large furnaces in steelmaking plants	23
Manipulators for Welding	"	Shows how " flat " welding can be facilitated	11
The Heat of the Moment	"	" Mrs. Feather " demonstrates the advantages of " Redring " boiling plates	9
Beauty Enriched by Light	British Thomson-Houston Co., Ltd.	Production of the " Mazda " lamp	15
Faraday	"	Illustrates experiments carried out by the great scientist	8
Resistance Welding	"	Examples of spot, projection, seam, butt and flash welding	60
Electronics	"	Animated diagrams demonstrate the principle of the electronic valve	35
Electronics in Industry	"	Electronic control methods explained	35
B.T.H. Amplidyne	"	Shows the development of the amplidyne from an ordinary d.c. generator	8
Aerojet Circuit Breaker	"	Manufacture from planning stage to final assembly	22½
Electric Traction	"	In three parts: (1) " Battery Vehicle "; (2) " Trolley-bus "; (3) " Electric Trains "	47½
Electric Ship Propulsion	"	Shows ships equipped with B.T.H. electric drives and explains the systems in detail, with diagrams	30
The Cathode Ray Tube	"	Operation and application to radar	33
Manufacture and Laying of 132 kV Impregnated Pressure Cable	British Insulated Callender's Cables, Ltd.	Traces the cable from the Erith Works to final site test	28
Jointing 132 kV Impregnated Pressure Cable	"	Shows how problems were dealt with in a specific case	30
Manufacture, Laying and Jointing 66 kV Oil Filled Cables	"	Production at the Prescot factory and work on site	40
Jointing 66 kV Oil Filled Cable	"	Details of operations and tests	27
Railway Electrification—Liverpool St. to Shenfield	British Insulated Callender's Construction Co., Ltd.	Installation of overhead traction equipment	34
Prelude to Power	"	Building of the Castelo do Bode (Portugal) hydro station and its 150 kV transmission line	40
750ft Television Mast at Sutton Coldfield	"	Erection from centring of base plate to completion of dipoles	8
Experimental Transmission Line at Leatherhead	"	Erection of special B.E.A. research system for 275–500 kV	7
More Power to Uganda	"	Electricity distribution in Uganda and work on the Owen Falls 66 kV transmission line	16
Linesmen over the Thames	"	Renewal of the conductors of the Thames grid crossing	15
Power Cable Laying	"	Complete record from digging of the trench to reinstatement	16
Building Britain's Grid	"	Construction of foundations, tower erection, line stringing, etc.	32
Crossing the Wyre	"	Transport and laying of 33 kV cables across the Wyre estuary	21
Mattresses for River Beds	"	The laying of brushwood mats for the protection of cables	6
Railway Electrification in Brazil	"	Overhead work on the former Sao Paulo Railway	12
Tom Puss and the Haunted Castle	Philips Electrical, Ltd.	Colour film on better lighting	4½
Stat on Glass	"	Electric lamp manufacture and applications	16
Light Up and See	"	Manufacture of electric lamps	20
What do you know about TL?	"	Manufacture of fluorescent lamps	4
Light Show	"	Colour " puppetoon " film presenting Philips lamps " on ice "	3

List of Films Available—*Continued*

Title of Film	Sponsors	Brief Description	Running Time (minutes)
Terra Incognita	Philips Electrical, Ltd.	Development, manufacture and application of the electron microscope	29
From Alchemy to Atom Splitting	,,	Tracing the advance of science from the medieval alchemist to the present day	18
Secret Writings of Electrons	,,	Use of the oscilloscope for detecting faults, etc.	15
Spectrum	,,	Research in the instrument field	30
All the World Over	Hoover, Ltd	Manufacture and sale of vacuum cleaners	31
Smoothing Things Over	,,	Cicely Courtneidge demonstrates the steam-or-dry iron	2
It's About Time	,,	The cleaner in a suburban home	22
Consider the Carpet	,,	Showing carpet manufacture and cleaning methods	19
Time Off My Hands	,,	Washing machine selling	20
Power Without Smoke	Brook Motors, Ltd.	Case for individual drives in industry	20
Distinguished Company	,,	Tour through a modern electric motor factory	40
They're Called Electrons	Edison Swan Electric Co.	Nature and behaviour of electrons explained (batteries, lamps, valves, etc.)	30
The Acid Test	,,	Manufacture and maintenance of starter batteries	20
Pattern of Light	British Luma Co-operative Elec. Lamp Soc., Ltd.	Production of incandescent lamps	20
Installing Armoured Cables	Central Film Library	American house wiring system compared with British methods	40
Boiler House Practice	,,	Fuel economy in the boiler house	26
Steam	,,	Efficient use of steam in the boiler house	21
Sifting Fact from Fancy	Joseph Lucas, Ltd.	Research, development and quality control in the manufacture of electrical equipment	17
Beyond the Pylons	Crompton Parkinson, Ltd.	Demonstrates modern electrical manufacturing methods	50
Combustion	International Combustion, Ltd.	Coal formation, composition and combustion: use of pulverized fuel	35
Steam	Babcock & Wilcox, Ltd.	Principles of w.t. boiler design and manufacture and operation	40
Combustion and the Chain Grate Stoker	,,	Chemical and physical principles underlying coal combustion	25
Pulverized Fuel	,,	Application of p.f. firing to w.t. boilers	40
Resistance Welding Aluminium	Aluminium Development Association	Principles of operation	10
Argonarc Welding Process	British Oxygen Co., Ltd.	In two parts (1) general, (2) aluminium	63
Arc Welding	Sound Services, Ltd.	Production of sound welds	20
Water Power	G.B. Equipments, Ltd.	Methods of utilizing water for generating electricity	11
The Steam Turbine	,,	Development from Hero of Alexandria to Parsons	16
Electro-Magnetic Induction	,,	Principles demonstrated by animated diagrams	17
Cathode Ray Oscillograph	,,	Construction and applications	25
The Microphone	,,	Explanation of carbon and ribbon types	9
Atomic Physics (five parts)	,,	From atomic theory to uranium fission	From 11 to 23
**Portable Powered Tools*	Ministry of Works	Uses and advantages of portable tools in the building industry	11
**Telephone Cable Jointing*	G.P.O.	Training film	21
**Telephone Cable Plumbing*	,,	,,	24
**Testing Poles for Decay*	,,	,,	17
**Overhead Line Construction:—*			
**Strengthening an Overhead Route*	,,	,,	18
**Wiring an Overhead Route*	,,	,,	15
**Erecting a Heavy Pole by Derrick*	,,	,,	6
**Kicking Poles*	,,	,,	9
**Erection of an Aerial Cable Suspension Wire*	,,	,,	11
**Erection of Aerial Cables*	,,	,,	19

* Obtainable from the Central Film Library.

Addresses of Sponsoring Organizations

ALUMINIUM DEVELOPMENT ASSOCIATION, 33, Grosvenor Street, London, W.1.

BABCOCK & WILCOX, LTD., Farringdon Street, London, E.C.4.

BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION, 2, Savoy Hill, London, W.C.2.

BRITISH ELECTRICITY AUTHORITY, Winsley Street, London, W.1.

BRITISH INSULATED CALLENDER'S CABLES, LTD., and BRITISH INSULATED CALLENDER'S CONSTRUCTION CO., LTD., B.I.C.C. Group Film Library, 21, Bloomsbury Street, London, W.C.1.

BRITISH LUMA CO-OPERATIVE ELECTRIC LAMP SOCIETY, LTD., Hardgate Road, Glasgow, S.W.1.

BRITISH OXYGEN CO., LTD., Bridgewater House, Cleveland Row, St. James's, London, S.W.1.

BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, London, W.C.2.

BROOK MOTORS, LTD., Empress Works, Huddersfield.

CENTRAL FILM LIBRARY, Government Building, Bromyard Avenue, Acton, London, W.3.

CROMPTON PARKINSON, LTD., Crompton House, Aldwych, London, W.C.2.

EDISON SWAN ELECTRIC CO., LTD., 155, Charing Cross Road, London, W.C.2.

G.B. EQUIPMENTS, LTD., Mortimer House, 37–41, Mortimer Street, London, W.1.

HOOVER, LTD., Hoover House, 211–213, Regent Street, London, W.1.

INTERNATIONAL COMBUSTION, LTD., 19, Woburn Place, London, W.C.1.

LUCAS, JOSEPH, LTD., Great King Street, Birmingham.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.

PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2.

SOUND SERVICES, LTD., Guild House, Upper St. Martin's Lane, London, W.C.2.

In addition to the British films detailed above the United States Information Service in the United Kingdom, the American Embassy, 5, Grosvenor Square, London, W.1, has a number of industrial electrical films available on loan to approved borrowers. These are set out in the following list.

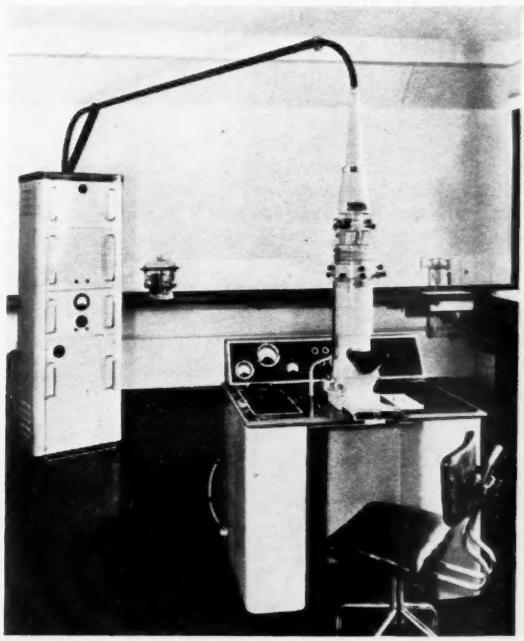
Title of Film	Brief Description	Running Time (minutes)
When Good Neighbours Get Together	Distribution of electricity to farms through the assistance of the Rural Electrification Administration	16
Hoover Dam	The damming of the Colorado River for irrigation and power	32
Valley of the Tennessee	Power development and flood control by the celebrated T.V.A.	35
Advantages of A.C. Welding	Comparison of a.c. and d.c. methods	19
Commutation of D.C. Machines	Mechanical and electrical problems of commutation simply explained	24
Inside of Arc Welding	A six-part film covering various phases of the subject	10 (each part)
Modern Materials Handling	Use of the battery fork-lift truck	32
Radio Frequency Induction Heating	Brazing, welding, annealing and heat-treating small metal parts in quantity	10
Selecting the Right Industrial Power System	Diagrammatic discussion of eleven accepted methods	20
City Out of Darkness	Rebuilding of the Western Berlin power plant	10
The Invisible Link	Development of Austrian power with Marshall Aid	13
The Diode	Basic features and applications	17
The Triode	"	13
The Electron	Nature of electrons and electron flow, control, etc.	16
Look and Listen	Non-technical explanation of television	10
Principles of Electricity	Animated drawings explain the nature of electrical energy, its production and use	20
Principles of Gas-filled Tubes	Theory of ionization, control of current, etc.	15
Stepping Along with Television	Showing means of transmitting programmes by coaxial cable and radio relay	11

VIRUSES AND THE ELECTRON MICROSCOPE

AS a result of medical researches the infective agents of most diseases have now been isolated and examined in detail. In the case of diseases and infections caused by bacteria it has been possible to study the organisms under optical microscopes, but a considerable number of diseases are due to viruses, which are almost all beyond the resolution of the optical microscope.

The advent of the electron microscope allows viruses of all types to be observed for the first time, and a considerable number of animal, plant and insect viruses have now been photographed. Though at first it was only possible to study purified suspensions of virus, the striking advances of the past few years in the technique of cutting very thin tissue sections enable viruses to be studied in the host cell, and much more valuable information can be obtained.

With the aid of these and other new techniques still to be developed, the electron microscope may be expected to play an increasingly useful part in making possible the direct observation of the " sub-microscopic " material involved in the complex studies which are required to elucidate the nature and action of the viruses so far unconquered. In this connection mention may be made of the electron microscope EM3 which has been produced by the Metropolitan-Vickers Electrical Co., Ltd., and is installed at the Poliomyelitis Research Foundation of the South African Institute of Medical Research, Johannesburg. It is believed that the EM3 electron microscope will be quite capable of viewing the poliomyelitis virus once this particular virus has been isolated.



Right: The EM3 electron microscope

Engineering in Europe

Abstracts from Technical Journals

ALMOST all the modern problems in switchgear design are due to the general trend of interconnecting increasingly powerful systems and of raising the transmission voltages and transmitted powers. These tendencies compel the designers to reinforce the insulation of the circuit breakers which, however, is possible without using new principles of insulation or new materials. The mode of operation of modern air-blast or oil-jet breakers may also be retained for handling greater powers on short-circuit and higher voltages, as proved by the experience in the Swedish 380 kV system where the switchgear, mostly supplied by three Swiss (and one Swedish) firms answered very satisfactorily.

Another problem that nowadays has become more acute is the raising of the ratio of breaking voltage to rated voltage. This is necessary on account of the rare, but possible, cases of breaking in phase opposition, which mainly affect circuit breakers controlling interconnectors of two systems. An analysis of the chance of such cases arising at all shows that its probability is very small; nor do statistics record any damage due to such cases, if they actually occurred.

A further problem is connected with the spreading practice of rapid reclosing after faults for which modern circuit breakers have to be generally suitable. This implies that the breaker at the, possibly required, second opening must be in the same condition as during the first tripping. This problem has also been solved for all the types of breakers now used.—" Present-Day Problems in the Design of H.V. Circuit Breakers," A. Roth, *E.u.M.*, Vol. 70, No. 19, pp. 425–430, 1st October, 1953, in German.

Stresses on Line Insulators

Insulator specifications contain as a rule only data on static mechanical stresses which the insulators can withstand, whereas the dangerous stresses under service conditions are mainly of a dynamic character. For this reason Electricité de France and a firm producing insulators set up a well-equipped mechanical testing station on a tower of a 150 kV overhead line directly behind the descent of the line from a mountainside of 2,000ft altitude into a plain. The climatic conditions of the region are severe, so that the measuring results could be relied upon to represent extreme conditions. Three types of specially designed dynamometers with strain gauges were used, and the readings taken by compensated bridge circuits connected to recording instruments. Oscillograms of the vibrations were also made continuously.

As expected, the maximum stresses were due to snow or ice loads (up to 6,750 kg as against normal stresses of 2,600–2,800 kg). The wind loads were negligible by comparison, i.e., of the order of 400–600 kg, with a double periodicity, viz., a low frequency of about 6 c/s and a higher frequency of up to 80 c/s; the amplitude of the latter vibration was small and generally variable in character. There is no doubt that the results of further observations, extended over longer periods, will be of great interest.—" Contribution to the Investigation of the Mechanical Stresses to which Line Insulators are Subjected under Service Conditions," P. Schuepp, L. Gion and J. Deberon, *R.G.E.*, Vol. 62, No. 10, pp. 479–496, October, 1953, in French.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

Wind Stresses on Overhead Lines

The existing regulations on mechanical design of overhead lines have recently been revised in many countries in the sense of an easing of the conditions, as a result of long observations and tests on lines in actual service. The wind stresses on the conductors have been hitherto overrated and as a consequence of the modification of the previous assumptions the wind pressures to be assumed for design purposes have been reduced. The author presents results of a test series and measurements carried out on French overhead lines, especially bearing on the deflections of the insulator strings for which a very simple and sturdy recording " maximum deflection indicator " was designed and used. Preliminary tests with these indicators showed that the readings were affected by errors smaller than 5 per cent. Of these indicators 500 were installed on overhead lines of 63 to 225 kV, and their readings on days with wind speeds exceeding 15 m/sec compared with the meteorological bulletins referring to the regions concerned.

An attempt is made to fit the results of the actual measurements into the " classic " calculation of the chain deflections. Also, the results are compared with Swedish measurements at the corresponding wind speeds and the agreement is fairly good considering the climatic and topographical differences of the two countries. A reduction of the fundamental assumptions of wind pressure in the French regulations thus seems justifiable.—" Effects of High-Velocity Winds on Overhead Line Conductors," R. Poyart, *Bull. Soc. Franc. Elect.*, 7th series, Vol. 3, pp. 735–748, November, 1953, in French.

Overhead Line Towers

The problem considered is whether statically and dynamically correctly designed overhead line supports are also economic. The method of calculation is in itself well established, but the values inserted in the formulæ, considering influences of wind and weather are actually empirical values, gained by observations extending in the best of cases only over a few years, and considering certain repetition frequencies, or incidences, of natural phenomena, the latter being obtained by averaging and probability processes. This is the point where, possibly, incorrect extrapolations are made, since it is required to forecast, and actually assure, a long service life of structures from data collected over a comparatively short period.

The required safety can always be provided by overdimensioning, but then it would be more costly. The method explained is really due to R. Gibrat (*Les inégalités économiques*, Paris, 1931, now out of print) and here applied to the special problem of a linear extrapolation of the normal frequency of accidental meteorological phenomena, such as wind speeds, atmospheric precipitations, ice loads, etc., using probability curves on a semi-logarithmic scale, from observations over a six years' period. The results are used for calculating the risks of a failure of overhead line towers under " catastrophic " wind speeds, from which " optimum risks " may be determined, expressed by a certain weight of the tower for any given permissible stress figure.—" Optimum Dimensions of Overhead Line Towers," V. List, *Elektrotech. Obz.*, Vol. 42, No. 7–8, pp. 364–367, 1953, in Czech.

Radio and Electronic Components

ELEVENTH R.E.C.M.F. PRIVATE EXHIBITION

THERE were 130 exhibitors in the eleventh British Radio Component Show which was held at Grosvenor House, London, this week (6th to 8th April). This was more than ever before and included six firms which had not previously taken part in this annual private exhibition organized by the Radio and Electronic Component Manufacturers' Federation. Generally acknowledged to be of real value to the technical visitor, this compact and bright exhibition crowds into the space of a few thousand square feet a representative display of an industry which employs 40,000 people and turns out nearly a thousand million radio and electronic components, valves and accessories a year. The exhibits are all British made and include components for the radio, television, electronic and telecommunication industries, as well as gramophone components, valves and test gear.

Television Developments

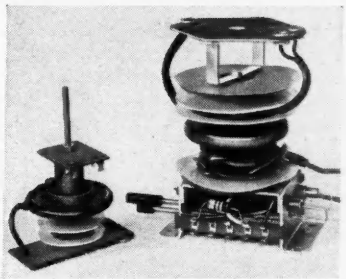
As was to be expected, there were a good many exhibits catering for the development of television all over the world and for its expansion in Great Britain to the higher frequencies. Several manufacturers showed multi-channel tuners for television receivers, there were valves for the new British television frequencies and cathode ray tubes with improved focusing units.

Among several new valves to be introduced by the General Electric Co., Ltd., were two which had been developed for use in frequency modulated radio receivers and for Band III television receivers at frequencies in excess of 200 Mc/s. This firm also showed junction and point-contact type transistors, long range photo-electric control equipment, a range of television and instrument cathode ray tubes, including 14in and 17in rectangular picture tubes with aluminized screens and grey filter-glass faces.

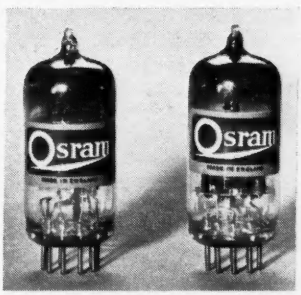
A range of a.m./f.m. valves for broadcast receivers was shown for the first time by Mullard, Ltd., as well as junction and point-contact transistors, and a 21in diagonal television picture tube having a rectangular screen. This tube, which is intended for export receivers, incorporates an ion trap, and the electron gun is specially designed to give uniform focus over the whole screen. Apart from a wide range of " Brimar " valves and cathode ray tubes Standard Telephones & Cables, Ltd., displayed germanium junction photo-electric cells together with a panel of circuit recommendations. The introduction by this company of germanium power rectifiers marks a big step forward in "miniaturization" since they are only about a quarter of the size of the present metal rectifiers and afford a considerable saving in weight. The efficiency is about 90 per cent which is much greater than in any existing type of valve or metal rectifier. Germanium diodes and rectifiers of all types were shown by the Westinghouse Brake & Signal Co., Ltd.

Valves and cathode ray tubes were also shown by such firms as the Edison Swan Electric Co., Ltd., and Ferranti, Ltd., the latter also having on view its " Pentland " series of resin cast components which includes power transformers, chokes, signal and pulse transformers and delay networks. Suitable for incorporation in military and marine radar equipment a range of 3 cm and 10 cm T.R. cells was also shown. Another interesting exhibit of the Edison Swan Electric Co., Ltd., was a 12 position pre-tuned r.f. and mixer stage for multi-channel television receivers operating in Bands I and III. A 12 channel tuner for the same duty was shown by the Plessey Co., Ltd., together with loudspeakers, variable capacitors of all types, wirewound potentiometers, electrolytic capacitors and a new development in high insulation scan coil technique comprising a polythene insulated high impedance coil which is of particular value in " direct drive " circuits. In conjunction with this component are two designs of e.h.t. transformers of the " direct drive " type which gave a range of 9 to 14 kV. The range of television deflector coil assemblies made by the Igranic Electric Co., Ltd., has been extended and the display included several models embodying improved sensitivity and efficiency. A multi-channel turret television tuner was also shown by Sidney S. Bird & Sons, Ltd.

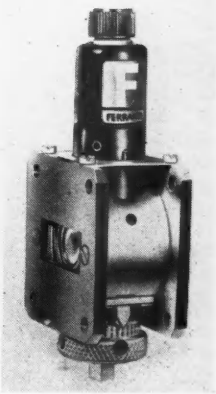
Apart from cathode ray tubes and valves for broadcasting, radar, television and v.h.f. links the English Electric Co., Ltd., had on view hermetically sealed and open type " C " core transformers and chokes together with examples of a new range of " E " cores developed to meet the need of small three-phase h.f. transformers, used in aircraft electrical and other mobile equipment. To utilize its present range of " C " type cores the Woden Transformer Co., Ltd., presented a new series of resin cast type components. The advantages here are complete mechanical and climatic protection, good heat dissipation,



Plessey line/e.h.t. scanning transformers showing new " direct drive " circuit (left)



G.E.C. valves for Band III television receivers



Ferranti T.R. cell for military and marine radar equipment

and robust terminals and fixing bushes. Another new development by this firm is a range of current and potential transformers designed to cover the requirements of industrial electronic engineers.

A special display was made by Parmeko, Ltd., of its " Jupiter " series of resin cast transformers which has been developed to meet the adverse climatic and humidity conditions set out in RCS 214 and the construction may incorporate either laminations or " C " cores. The company also had on view its " Saturn " range of transductors for magnetic amplifiers, together with a wide diversity of power transformers. Resin cast transformers and chokes were also shown by Gresham Transformers, Ltd., alongside a collection of recently developed high-temperature lightweight transformers. Transformer laminations of all kinds were to be seen on the stands of such firms as Magnetic & Electrical Alloys, Ltd., Geo. L. Scott & Co., Ltd., and the Telegraph Construction & Maintenance Co., Ltd.

Wires and Cables

The last company also had coaxial and other specialized types of cables together with a display of more standard lines. British Insulated Callender's Cables, Ltd., showed connecting wires insulated with p.v.c., polythene, p.t.f.e., and silicone rubber; miniature multi-way cables; radio frequency cables; and winding wires. W. T. Henley's Telegraph Works Co., Ltd., also displayed a comprehensive range of cables and connecting and winding wires. Winding wires of all types were shown by Connollys (Blackley), Ltd., while apart from p.v.c. and polythene insulated wires and cables Duratube & Wire, Ltd., showed examples of the new nylon sheathing technique and for the first time in this country displayed extruded insulation in two and three colours, spirally applied.

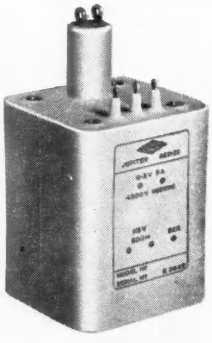
Wave winding demands characteristics which are not normally present in conventional textile covered wires and both single and bunched textile insulated conductors for this duty were shown by Fine Wires, Ltd. Silicone bonded glass fabric insulating material was shown in various forms, including tubing, by Langley London, Ltd., while silicone enamelled wire for use at temperatures in the region of 180 to 200 deg C was included in the comprehensive exhibit of the London Electric Wire Co. and Smiths, Ltd.

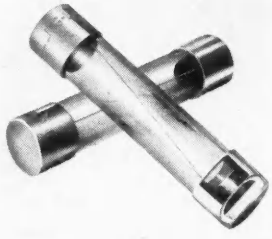
An important addition to the products of the Reliance Electrical Wire Co., Ltd., is the introduction of " noise free " cables which embody means of reducing spurious signals to a level lower than that of the " pick up " signal. The technique can be applied to any of the company's coaxial cables, and in some instances to multi-way screened types. Other wires and cables and insulating sleevings were shown by Suflex, Ltd., H. D. Symons & Co., Ltd., and the Vactite Wire Co., Ltd., while insulating materials of various types were to be seen on the stands of such firms as Bakelite, Ltd., Geo. Bray & Co., Ltd., British Moulded Plastics, Ltd., Bullers, Ltd., H. Clarke & Co. (Manchester), Ltd., Creators, Ltd., Thomas De La Rue & Co., Ltd., Long & Hambly, Ltd., Micanite & Insulators, Ltd., the Mycalex Co., Ltd., Thermo-Plastics, Ltd., Tufnol, Ltd., and the United Insulator Co., Ltd. Cable binding and identification sleeves, injection mouldings, grommets and waterproof cable entries for plugs and sockets were shown in great profusion by Hellermann, Ltd.

Capacitors

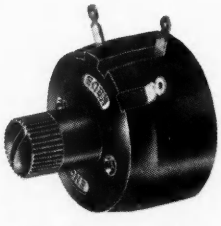
Among the ceramic and silvered mica capacitors shown by Stability Radio Components, Ltd., the latest development is a range of tubular ceramic decoupling capacitors which are offered in the smallest commercial tube sizes with capacitance values between 470 pF and 5,000 pF. The voltage ratings of 500 V d.c. and 250 V a.c. are conservative and it is significant that no derating is required for a temperature of 100 deg C. The new materials shown by Steatite & Porcelain Products, Ltd., included " Faradex H," a stable permittivity ceramic ($K = 3{,}200$), for by-pass capacitor manufacture, and " Frequentite S," a steatite-type material of extremely low dielectric loss ($\tan \delta < 0{\cdot}0002$). A newly introduced selection of miniature variable capacitors for v.h.f. circuitry was shown by Stratton & Co., Ltd., together with a variety of other specialized items, while the Dubilier Condenser Co. (1925), Ltd., showed an entirely new range of high K ceramic dielectric varnish protected tubular capacitors for general radio frequency applications and a new type of fully sealed metal encased tubular high K ceramic capacitor in both stand-off and bushing forms, which at frequencies even in excess of 150 Mc/s still act as capacitors. The company's range of " Duconol " capacitors for a.c. applications are fitted in aluminium containers, which are sealed by a novel process enabling substantial reductions in weight and dimensions to be made while providing for a higher working temperature than has hitherto been possible.

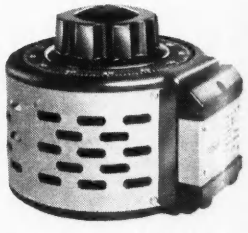
The capacitors of the Telephone Manufacturing Co., Ltd., range from h.v. types in welded steel cases to " Blister "



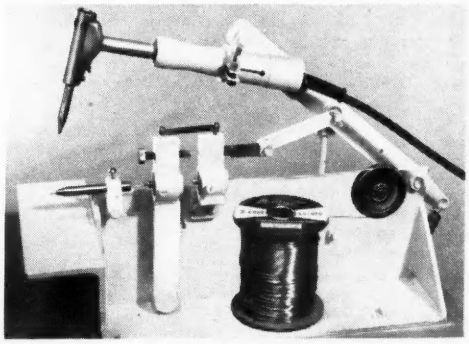


Above: Belling & Lee fuses with bonded glass, caps and filaments. Left: Parmeko " Jupiter " resin cast transformer

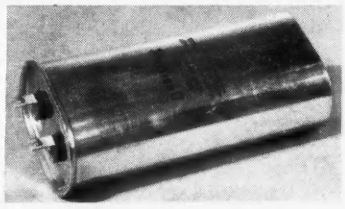




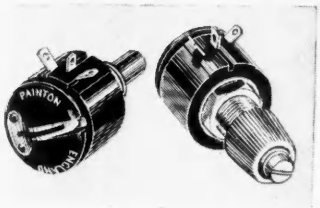
Left: Egen pre-set wirewound or carbon potentiometer. Right: Berco " Regavolt " continuously variable transformer



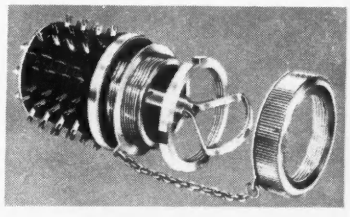
Multicore automatic soldering head



Dubilier " Duconol " capacitor for a.c. working



Miniature wirewound potentiometers by Painton & Co.



This " Cinch " voltage selector was originally developed for military applications

types for circuit decoupling, bulking no larger than a cubic inch. Polystyrene capacitors, which continue to find new fields of exploitation, are available in new forms for a.c. working, together with new case styles and mounting methods, including " potted circuit " technique for composite blocks. Apart from mica, ceramic and plastic film capacitors the Telegraph Condenser Co., Ltd., had on show a new collection of low leakage high quality electrolytic types which will be of interest to designers of low frequency amplifiers for grid coupling purposes. They are of tubular construction and are suitable for operation up to 85 deg C without voltage derating. The outstanding feature of these capacitors is their exceptionally low leakage which is such that for the first time it is possible to think in terms of insulation resistance of an electrolytic.

Recent developments by A. H. Hunt (Capacitors), Ltd., include electrolytic capacitors of high ratio anode construction, special types for television applications, for high temperature operation and miniature electrolytic tubular types for diminutive apparatus. New developments in mica construction are miniature stacked foil and silvered types. Various types of capacitors, many of them only recently developed, were also shown by Daly (Condensers), Ltd., London Electrical Manufacturing Co., Ltd., the Static Condenser Co., Ltd., and the Wego Condenser Co., Ltd.

Apart from capacitors now including ten temperature coefficients, Erie Resistor, Ltd., had a wider range of components than ever before. This company's resistors include the first fully insulated and fully approved Grade I high stability resistors to be produced in this country; Grade II solid carbon; and " Silertex " wirewound. Other products range from carbon potentiometers to ignition interference suppressors and printed circuits. The exhibit of Painton & Co., Ltd., comprised midget attenuators and faders which are now in production, miniature wirewound potentiometers, " Metlohm " stability resistors, knobs, plugs and sockets, push-button switches and wirewound vitreous enamelled resistors with adjustable contact tapping bands.

Among the new products shown by Egen Electric, Ltd., are two pre-set potentiometers, a carbon rotary control and a similar control incorporating a wire-wound element. Other new products include sub-miniature carbon pre-set potentiometers suitable for use in guided missiles and special test equipment. An interesting item on the stand of the British Electric Resistance Co., Ltd., was the rotary " Regavolt " continuously variable transformer, toroidally wound and having a brush rotated by a knob. Made in two sizes, 0·8 A and 2 A rating, they are the smallest variable transformers available in this country and they can be easily built into electronic equipment. Resistors were also shown by Morganite Resistors, Ltd., Electrothermal Engineering, Ltd., Erg Industrial Corporation, Ltd., N.S.F., Ltd., Welwyn Electrical Laboratories, Ltd., and A.B. Metal Products, Ltd.

Once again, the enormous range of products made by A. F. Bulgin & Co., Ltd., was on view and this year an even larger number of new additions has been made in various classes. The multiplicity of items in the " Cinch " range of components was displayed on the stand of the Carr Fastener Co., Ltd., including a new voltage selector providing ten tappings for two voltage ranges: 100 to 125 V and 200 to 250 V. It was originally developed for military requirements. Among the many items shown by Belling & Lee, Ltd., is a new version of the well-known general purpose instrument fuse link, L.1055, which is now made by a technique that bonds caps, glass and filament into one unit, the caps being so securely held that they will not come off unless the glass is broken.

The automatic soldering head demonstrated by Multicore Solders, Ltd., will be of particular interest to engineers planning repetition soldering processes for small parts. One model has no motive power so that it can be linked with an existing manufacturing process. Another is supplied complete with a bench and a foot operated pedal, while a third is motorized and can make joints at the rate of up to 3,000 an hour.

Of course, an important section of the exhibition was devoted to instruments and test gear. The firms represented included Salford Electrical Instruments, Ltd., Marconi Instruments, Ltd., the Automatic Coil Winder & Electrical Equipment Co., Ltd., Advance Components, Ltd., Dawe Instruments, Ltd., and Taylor Electrical Instruments, Ltd.

Aeronautical Radio Conference

The first meeting, at Chelmsford, of an Aeronautical Radio Conference, jointly sponsored by Marconi's Wireless Telegraph Co., Ltd., Amalgamated Wireless (Australasia), Ltd., and the Canadian Marconi Co. has just been brought to a successful conclusion. One of the principal objects of the conference was to facilitate the exchange of views, opinions and information relative to all aspects of aeronautical radio-electric services, and thereby to provide a sound basis for the joint consideration of technical requirements and means for satisfying them.

Mr. F. N. Sutherland, the general manager of Marconi's, in his address of welcome to the delegates, laid particular emphasis on the task ahead of them. He suggested that two salient points had to be borne in mind; one was the increasing complexity of aeronautical radio requirements; and the second, the tremendous importance of radio as a prime means of increasing the reliability and safety of all forms of air transport.

During the ensuing nineteen days of the conference the delegates discussed every aspect of aeronautical radio, and especial consideration was given to development and production plans and programmes.

TRANSISTOR CIRCUITRY

Joint Meeting of I.E.E. Radio and Measurements Sections

FOUR papers dealing with various aspects of transistor circuitry were presented at a joint meeting of the Radio and Measurements Sections of the Institution of Electrical Engineers in London on Wednesday. In the first of these Mr. E. H. Cooke-Yarborough describes a method of designing point-type transistor switching circuits so that relatively large direct currents (of the order of several tens of milliamperes) can be handled with a voltage drop of only one or two volts.

The point-type transistor is well suited for use in two-state circuits such as are employed in computers and electronic counting apparatus. This is largely because it has a current gain exceeding unity without phase reversal, so that a bistable circuit using a point-type transistor can be very simple. Circuits of this type have been described by a number of authors, including F. C. Williams and G. B. B. Chaplin in *Proc. I.E.E.*, 1953, 100, Part III, p. 228. The principle of circuit design used by these two authors is to feed defined currents to the various electrodes of the transistor in order to minimize the effects of variations in the transistor characteristics. However, this type of circuit suffers from the disadvantages that rather large supply voltages are necessary, so that the currents fed to the electrodes may be largely independent of electrode potentials, and because the steady electrode currents are defined, currents to drive other circuits are available only as short pulses.

The circuits described in the paper are believed to be equally tolerant of transistor variations, while having somewhat greater flexibility and needing considerably smaller supply voltages. Their most important advantage, however, is that they are able to feed relatively large direct currents to external circuits. This is particularly important in digital computers, where one bistable circuit may have to operate many gating circuits.

The circuits depend essentially upon a current gain greater than unity, and there is therefore no close analogy in the fields of junction transistors or thermionic valves. The behaviour of these circuits, however, in many ways resembles that of gas-filled triodes, largely because at high currents the output impedance is low while at low currents it becomes negative and large. In both cases turning-off is something of a problem. The transistor circuits have advantages over the gas-filled-triode circuits in that the negative resistance part of the characteristics can be controlled by the external circuit and that the turning-off pulse can be applied to an electrode (the base) having only a small voltage swing. The application to transistor circuit design of circuit principles derived from established gas-filled-triode practice may form a promising line of development.

Small-Signal Characteristics

The second paper, by Messrs. E. H. Cooke-Yarborough, C. D. Florida and J. H. Stephen, describes the measurement of the small-signal characteristics of point-type transistors over a wide range of emitter currents, including those of less than 1 μA. From the work described there are indications that measurements in the region below 10 μA may throw light on the phenomena which occur in point-type transistors, although it has not been possible to pursue this aspect of the work. The results obtained show that, with suitable circuit design, transistors can be used in stable triggered circuits which under favourable conditions have a charge sensitivity approaching that of triggered thermionic valve circuits.

A rather unexpected conclusion is that an enhanced current gain at low emitter currents is not helpful in improving the triggering sensitivity, since its effect is to lower the slope of the curve relating transistor negative resistance and emitter current and make the triggering point less well defined. An ideal transistor would maintain a current gain not very different from the high-emitter-current value at currents down to about 1 μA.

Transistor Parameters

In another paper by Dr. A. R. Boothroyd and Mr. S. K. Datta a bridge is described for measuring the a.c. parameters of point-contact transistors at 1,000 c/s for chosen d.c. operating conditions. Essentially the bridge involves the comparison of the transistor with a circuit representation of its a.c. equivalent T-circuit. The elements in this equivalent circuit represented by variable resistances, are adjusted in turn to equal one of the transistor parameters, a condition indicated by the balancing of a bridge. With the circuit arrangement described it is possible to measure the transistor parameters to an accuracy of approximately ± 3 per cent.

An outstanding feature of the bridge is the rapidity and ease with which the transistor parameter may be measured. For given d.c. biasing conditions it has been found possible to measure a set of four transistor parameters in five minutes or less. However, the bridge is not considered appropriate for the measurement of junction-transistor parameters, the basic objection being that a.c. open-circuit conditions need to be simulated accurately in both the emitter and collector circuits. For junction transistors, it has been found most convenient to use a bridge based on the transistor equivalent circuit described by G. Knight, R. A. Johnson and R. B. Holt in *Proc. I.R.E.*, 1953, 41, pp. 983–9. Here the a.c. parameters are defined with the emitter open-circuited and the collector short-circuited to the base.

Regenerative Amplifier for Computers

The final paper, by Mr. G. B. B. Chaplin, which deals with the transistor regenerative amplifier as a computer element, begins by pointing out that a method of designing transistor two-state circuits which accepts transistors having a relatively large spread in characteristics has already been described by F. C. Williams and G. B. B. Chaplin in *Proc. I.E.E.*, 1953, 100, Part III, p. 228. Although the subsequent improvement in the uniformity of transistors has removed the primary object of the system, it has been retained in the circuits described in the paper because of the many other advantages it confers where accuracy and speed of operation are important.

The transistor is considered as a regenerative amplifier, and the first part of the paper describes various methods of connection and endeavours to evaluate the merits of each circuit. The second part illustrates the application of some of the basic circuits to more complex circuits of the type used in digital computers. These circuits operate at a basic frequency of 120 kc/s and use rectangular pulses

to allow adequate time for comparing two or more waveforms and performing operations on them.

The adequate stage gain, low output impedance and standard output pulse of the transistor regenerative amplifier make it eminently suitable for computing-type circuits. In particular, those circuits having rectangular output waveforms have been chosen as being most suitable for the comparison of two or more pulse trains and subsequent operation on them.

The liberal use of current sources and catching diodes allows faster and more reliable circuit operation, but is at the expense of increased power consumption. Even so, the power consumption is considerably less than in the equivalent valve circuits, and for most computer applications speed and reliability are of prime importance.

The reliability of currently available transistors appears to be very good, and many of the failures commonly attributed to the transistor are probably the result of accidental short-circuiting of one of the electrodes to some fixed potential, causing the transistor to fuse. Precautions are taken in both the design and layout of the circuits to minimize this danger, and it is significant that no failures have occurred in circuits which were left operating without interference.

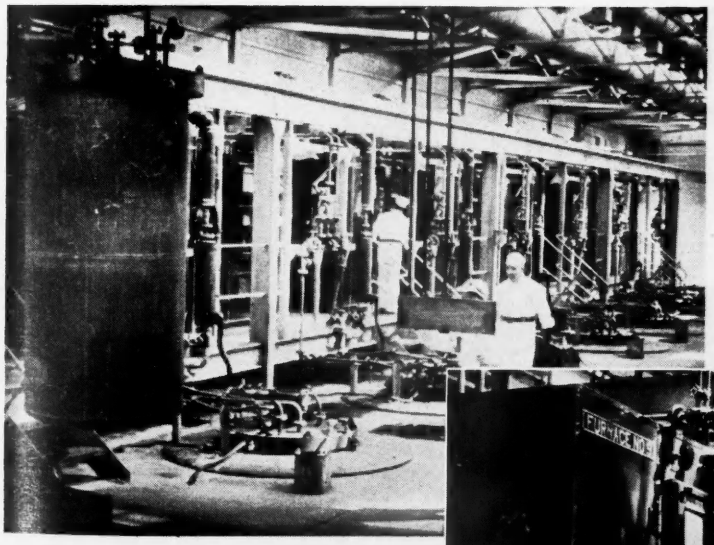
URANIUM PRODUCTION

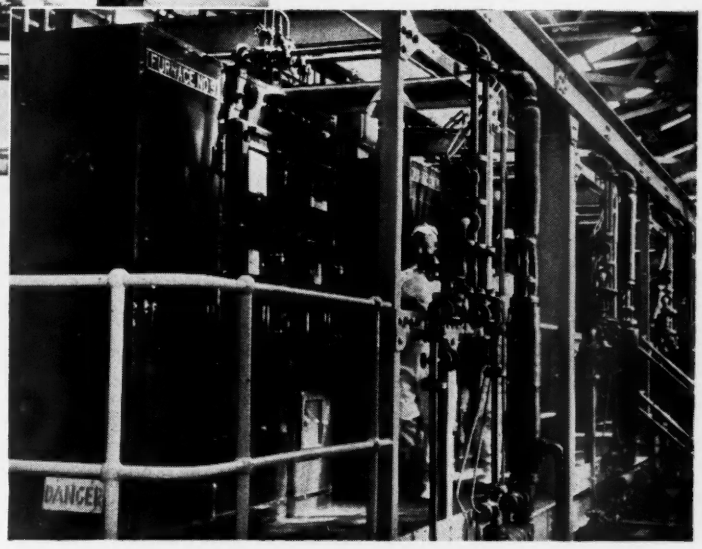
A £500,000 *Order for Furnaces*

DETAILS have been released of an order, valued in the neighbourhood of £500,000, placed by the Ministry of Supply with the General Electric Co., Ltd. The equipment is for use in the production of uranium metal and comprises 54 vertical cylindrical furnaces, each rated at 100 kW, and 200 furnace pots. The furnaces have been supplied with containers, control and unloading gear and cranes. They have a heated depth of 6½ft and a maximum temperature of 750 deg C. Forced air cooling is provided for the furnaces and charges. The furnace pots have a diameter of 3ft 5in and a depth of 7ft 1in.

The processes for which these furnaces are used are those concerned with converting pure ammonium diuranate to metallic uranium and are characteristic of a metallurgical works. The diuranate is converted to the metal in two stages; in the first it is converted to pure uranium tetrafluoride by heating the powder in G.E.C. furnaces, reducing it, and then passing over hydrogen fluoride gas at the appropriate temperature; this results in the formation of solid uranium tetrafluoride. This fluoride is then removed from the furnace, mixed with chips of calcium metal in a mould, and fired, resulting in its reduction to metal. Some difficulty at first experienced with corrosion of the furnace linings and pipes used in this process has been overcome by using "Inconel."

The mixture of tetrafluoride and calcium is put in a mould in a steel pot; the mould is placed in a steel enclosure fitted with a dust collector; steel doors are closed after bells have warned workers to get out, and an operator presses the switch of a firing mechanism to initiate the reaction. Through thick green glass he watches a red glow in the heart of the mould grow rapidly whiter and bigger as it spreads through the mass of reacting material, until finally it is like a small white sun spitting stars into the dark of the enclosing chamber. Then the spitting dies down, the reaction is over, and a slowly cooling mass of uranium is left. Later the mould is withdrawn and the billet removed, a cylinder with an uneven surface, very heavy indeed. The surface of the billet is cleaned to remove any adhering slag, an identification number is stamped on it, and a small quantity is drilled out for chemical analysis. When the uranium has been checked against the specifications, the billet is taken to another building and remelted in an electric furnace, from which it is run out into moulds to make rods suitable for casting. This casting is done in vacuum by a method developed at Harwell and by the Development Branch at Springfields in collaboration.





Above: Taking one of the 200 furnace pots from the furnace at the Dryway plant, Springfields. Right: Some of the 54 control panels

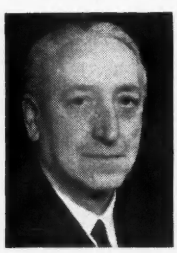
PERSONAL AND SOCIAL

News of Men and Women of the Industry

THE Minister of Fuel and Power has announced the following appointments and re-appointments as part-time members to Area Electricity Boards:—

East Midlands:—**Mr. J. T. Graham,** A.R.T.C., M.I.Mech.E., Nottingham, **Ald. A. Sturgess,** O.B.E., J.P., Derby, and **Mr. G. H. B. Wilson,** C.B.E., M.C., A.F.C., J.P., Nottingham (re-appointments). **Ald. A. Joyce,** C.B.E., J.P., Kettering, and **Ald. J. Minto,** J.P., Leicester, have retired from the board on completion of their terms of office. North Eastern:—**Mr. J. Bowman** (appointment). Midlands:—**Councillor H. T. Fullwood,** Wolverhampton (appointment). **Mr. C. R. Heathcock,** F.C.I.S., Stourbridge, and **Mr. J. McDowell,** Sutton Coldfield (re-appointments). Yorkshire:—**Ald. R. Barber,** J.P., Bradford, **Ald. J. H. Bingham,** LL.D., J.P., Sheffield, and **Mr. R. E. Crowe,** Doncaster (re-appointments).

Mr. G. M. Wright, C.B.E., B.Eng., M.I.E.E., relinquished his position as engineer-in-chief of Marconi's Wireless Telegraph Co., Ltd., on 1st April on reaching the retiring age, but remains with the company as full-time general technical consultant. Several consequent changes among the senior technical appointments came into effect on that date. **Mr. B. N. MacLarty,** O.B.E., M.I.E.E., takes over the position of engineer-in-chief. His deputy is **Mr. R. J. Kemp,** the present chief of research. **Mr. E. Eastwood,** Ph.D., M.Sc., M.I.E.E., deputy chief of research, replaces Mr. Kemp as chief at the company's research establishment at Great Baddow.



Mr. G. M. Wright

Mr. B. N. MacLarty

Mr. R. J. Kemp

Dr. E. Eastwood

Mr. Wright joined the company in 1912 and during the 1914-18 war held a commission in the R.N.V.R. In 1919 he returned to the Research Department of which he was appointed deputy chief in 1928, and later, chief. His work as a research engineer gained for him an international reputation, particularly in the fields of D.F. and facsimile telegraphy. During the last war he was seconded to the Admiralty, becoming chief scientist at the Admiralty Research Establishment. He returned to the company as engineer-in-chief in 1946. In 1948 he was appointed a member of the Radio Research Board of the Department of Scientific and Industrial Research. He was made a C.B.E. in 1950.

Mr. MacLarty joined the Development Establishment of the Aeronautical Department at Writtle in 1921. While there he constructed the Marconi experimental broadcast transmitter "2MT." In 1926 Mr. MacLarty transferred to the B.B.C. and, under Sir Noel Ashbridge, he was responsible for the design and construction of new transmitting stations, and later for all new engineering projects undertaken by the Corporation. He returned to the Marconi Co. in May, 1947, as deputy engineer-in-chief.

Mr. Kemp joined the company in 1917. From 1930 to 1939 he was engineer-in-charge of television research. During the last war he was responsible for Air Ministry special research at the Great Baddow Research Establishment, of which he became assistant chief in 1946. He was appointed chief of research in 1948.

Dr. Eastwood is a physicist who has been engaged primarily in research in the field of molecular constitution and in the application of radar techniques to the investigation of celestial noise and the detection of meteors. During the last war his attention was directed to radio work with the R.A.F. He joined the English Electric Co., Ltd., in 1946 in charge of their radiation laboratory, and in 1948 transferred to the Marconi Co. as deputy chief of research at the Great Baddow Establishment of which he now assumes control.

Mr. T. D. Childs, M.B.E., who has been acting manager in Glasgow for Siemens Electric Lamps & Supplies, Ltd., has been confirmed in that appointment as from 1st April. Mr. Childs joined the telephone equipment section of Siemens Brothers & Co., Ltd., in 1930, and in 1935 was appointed sales and maintenance engineer for Scotland. He was commissioned in the Royal Corps of Signals in 1941, and was awarded the M.B.E. in the 1951 New Year Honours for work in connection with the anti-aircraft defence of the Clyde. He joined the Glasgow branch of Siemens Electric Lamps & Supplies, Ltd., in 1946 as sales engineer, and became acting branch manager in 1953.

Mr. S. P. Maynard, B.Sc., A.M.I.E.E., has been appointed director and chief engineer of the Igranic Electric Co., Ltd. Mr. Maynard has been with the company since 1929 when he joined the Engineering Department. In 1935 he was appointed chief designer, development manager in 1953 and chief engineer in January of this year. Before joining the Igranic Electric Co. Mr. Maynard served a graduate apprenticeship with Mather & Platt, Ltd., Manchester, and subsequently served in the Electrical Distribution Department of the Southern Railway and with I.C.I., Billingham, as electrical engineer.

Mr. L. Copeland Watts, consulting engineer, has taken into partnership **Mr. J. R. Harrison,** B.Sc., A.M.I.C.E., M.I.H.V.E., A.C.G.I. The firm will continue to practice under the name of J. Roger Preston & Partners.

Mr. H. S. Allpress, A.M.I.E.E., F.I.E.S., is shortly leaving for a tour of duty as special representative in Iraq for the General Electric Co., Ltd., in collaboration with its agents, Iraq Mercantile, Ltd., of London, Baghdad and Basra. He will be in Baghdad during the British Trade Fair which will be held there from 25th October to 8th November.

Mr. J. H. Appleby, A.M.I.E.E., M.I.Mech.E., who, as we reported in our issue of 26th March, is joining La Electricidad de Caracas, Venezuela, will sail on the S.S. "Colombie" on 17th April, and takes up his appointment on 30th April. He will be engaged as a consultant to the company and his initial duties will be concerned mainly with distribution. His appointment, however, entails technical advice on most matters connected with the electricity supply industry.

Mr. J. H. Thompson, chief electrical engineer with Newcastle-on-Tyne City Transport Department for ten years, has retired after forty years with the Department. He has been succeeded by **Mr. W. Pollock,** who joined the undertaking in 1921.

Mr. Robert Wrathall has joined E. K. Cole, Ltd., as radio sales manager. He was for many years sales manager of Philips Electrical, Ltd., and recently relinquished the post of general sales manager of Vidor, Ltd. **Mr. R. A. Drummond,** formerly northern area manager, is appointed to the post of assistant sales manager, north, and **Mr. R. S. Underwood,** previously southern area manager, is the new assistant sales manager, south.

Mr. L. M. Ballam, hitherto senior representative at the London office of the Skefco Ball Bearing Co., Ltd., has been appointed manager at Bristol in succession to **Mr. E. Y. Caswell,** who has been transferred to the head office as sales manager.

Mr. A. B. Blunsden, M.I.Chem.E., A.R.I.C., and **Mr. J. R. James,** B.A., F.R.G.S., have been appointed to the board of Purimachos, Ltd., manufacturers of refractory cements.

Mr. E. W. Bennett, chief production engineer of Hoover (Electric Motors) Ltd., Cambuslang, has been appointed production manager, and **Mr. J. P. King,** assistant superintendent, Production Engineering Department, becomes superintendent of that department.

Dr. G. W. Sutton joined the directorate branch of Siemens Brothers on 1st April. For the past seven years he has been chief superintendent of the Signals Research & Development Establishment of the Ministry of Supply, to which he was appointed from the Royal Aircraft Establishment, Farnborough. His new post is that of director of research and education for the Siemens Brothers group of companies.

Dr. G. W. Sutton

Dr. Sutton was educated at the City of London School and the Royal Military Academy, Woolwich. After serving in France and Palestine during the 1914-18 war, he resigned from the Royal Engineers and was engaged on research on high voltage cables with Johnson & Phillips, Ltd. Following this he was appointed lecturer in electrical theory and measurements at the City and Guilds Engineering College. In 1930 he joined Siemens Brothers and was in charge of the general telephone laboratory until 1940 when he was lent by the company to the Ministry of Aircraft Production. For the remainder of the war he acted as co-ordinator for technical services between the Radio Department, Royal Aircraft Establishment, and Telecommunications Research Establishment, Malvern. At the end of the war he joined the scientific staff of the Ministry of Aircraft Production, which was subsequently merged with the Ministry of Supply. For two periods, from 1935 to 1939, and from 1946 to the present time, he has been an external examiner in telecommunications, electrical measurements and electronics for the London University.

Mr. K. C. J. Hutton has joined the board of the Sterling Cable Co., Ltd. He is particularly well known on the export side of the company's business, having made five world tours in the last six years, and being responsible for launching several new types of cable in the world markets. Mr. Hutton joined the company at the end of 1945, on his release from the R.A.F. He will continue to concentrate on the company's export business.

Mr. K. C. J. Hutton

Mr. F. J. Lane, O.B.E., M.Sc., M.I.E.E., transmission design engineer with the British Electricity Authority, has been appointed deputy chief engineer (transmission) of the Authority in succession to Mr. D. P. Sayers, who recently became deputy chairman of the Midlands Electricity Board.

Mr. N. C. Robertson, C.M.G., M.B.E., deputy managing director of E. K. Cole, Ltd., has been elected a director of Ekco Electronics, Ltd., a wholly-owned subsidiary company of E. K. Cole, Ltd.

In our last issue we briefly reported that **Mr. J. V. Daniel,** Associate I.E.E., and **Mr. E. T. R. Ball,** A.M.I.E.E., had been appointed directors of the British Electric Transformer Co., Ltd.

Mr. Daniel has been joint managing director of Crompton Parkinson, Ltd., since March, 1953, and is also a director of Austin Crompton Parkinson Electric Vehicles, Ltd.

Mr. Ball has been general manager of the B.E.T. works since January, 1947. He joined Crompton Parkinson, Ltd., in 1928 as a designer in the transformer department of the Chelmsford works. When that department was transferred to Hayes in 1933, a year after the entry of the British Electric Transformer Co. into the Crompton Parkinson group, Mr. Ball became assistant chief designer at Hayes. In 1940 he was appointed production manager and, in 1945, assistant general manager.

Mr. J. V. Daniel

Mr. E. T. R. Ball

Mr. W. J. Stay, chief engineer, retired from the Electric Construction Co., Ltd., on 31st March, following forty-seven years' service with the company. Friends and colleagues recently made him a presentation of a portable radio set and gold wristlet watch and later he was entertained to dinner by members of the machine design department, of which he was chief, when his colleagues presented him with gold cuff-links. Mr. Stay has been responsible for many specialized machine designs, including high frequency alternator sets for telecommunications and furnace work.

Mr. J. G. Christopher, T.D., F.I.E.S., has been appointed general sales manager of the Atlas Lighting Division of Thorn Electrical Industries, Ltd. Mr. Christopher joined the General Electric Co., Ltd., in 1925 and was trained as an illuminating engineer with that company. In 1931 he was lent by the G.E.C. to the London Underground Railways for 2½ years and undertook responsibility for the lighting of the Cockfosters extension and rebuilt stations in the Central London area. As a captain in the Territorial Army he served in France and Belgium, returning to Britain via Dunkirk, and in 1942 was promoted lt.-colonel in command of a Corps Signal Regiment. He was posted to command of No. 1 War Office Signal Regt. in late 1943, and finally went to India in 1944 as G.S.O.1 on General Auckinleck's staff and served as chairman, Wireless Board (India and S.E. Asia). Mr. Christopher rejoined the Territorial Army in 1949 to command a London T.A. Signals Regiment and was promoted colonel in 1953. In 1946 he rejoined the G.E.C. and in 1947 became assistant sales manager, Osram Lamp Department, from which appointment he has just resigned.

Mr. J. G. Christopher

Mr. G. B. Gill, M.I.E.E., consultant, Durban, South Africa, tells us that **Mr. M. Gray,** A.M.I.E.E., has joined him as a partner.

We regret that in the notice in our issue of 26th March relating to the appointment of **Mr. G. D. La Niece** as managing director of Dictograph Telephones, Ltd., we incorrectly referred to him as Mr. Niece.

Mr. F. R. Madge has been elected chairman of the Plymouth Branch of the Electrical Contractors' Association for the ensuing year.

In August of last year **Mr. P. H. Goddard** completed fifty years' service with the British Thomson-Houston Co., Ltd., and to commemorate the occasion a presentation was recently made by Mr. R. G. A. Dimmick, manager, industrial motor sales. Mr. Goddard joined the B.T.H. Co. in 1903 and after working in various departments he became power engineer, first at Newcastle-upon-Tyne district office and then Cardiff district office. He returned to Rugby to join the industrial motor sales department, specializing in the application of electric drives to waterworks and pumping plant. He served on the Rugby Borough Council from 1937 to 1950 and for six years he was chairman of the Rugby Corporation Electricity Committee. He also served on the Executive of the Incorporated Municipal Electrical Association.

Mr. A. D. Holmes has been appointed manager of the Electrical Department of Heal & Son, Ltd., in succession to **Mr. F. C. Phillips,** whose death occurred on 8th March.

Mr. W. Winstanley, director partner with Mr. W. J. Lambert in the firm of Winstanley & Lambert, Ltd., Liverpool, has been elected chairman of the Liverpool branch of the Electrical Contractors' Association. Other elections were:—vice-chairman, **Mr. T. K. Richardson;** hon. treasurer, **Mr. A. E. Chesters** (Wallasey); and secretary, **Mr. J. S. Johnson.**

New members elected to the Council of the Industrial Association of Wales and Monmouthshire include **Mr. F. A. Austin,** works manager, Hoover (Washing Machines), Ltd., Merthyr Tydfil. **Mr. D. H. Graham,** International Refrigerator Co., Ltd., Llandudno Junction, has been elected a member of the North Wales Executive Committee.

Mr. J. S. Dent and **Mr. H. H. Newhouse** have joined the board of Brentford Transformers, Ltd. Mr. Newhouse will continue to act as secretary of the company.

A very creditable presentation of Emlyn Williams' "Night Must Fall" was given on Wednesday and Thursday last week by the **Portland Players** (B.E.A.) at the Duthy Hall, London, S.E. The main burden was ably sustained by Renee Futcher, Anthony Moss and Cynthia Gidley; a particularly amusing performance was given by Mimi Hutchinson; and competent support was given by James Rintoul, Margaret McPherson, June Dobbs and Geoffrey Walker. The prologue was spoken by John W. Barber and the production was in the hands of Margaret Corkish.

Nearly 400 members and friends of the **B.T.H. (Willesden) Long Service Association** enjoyed themselves at the annual reunion at Wembley on 1st April. This year the Association has added thirty new members (people who have served the company for twenty-five years) and another thirty-two members each qualified for a further certificate which marks thirty years' service. The chief guest, Mr. H. L. Satchell, M.B.E., director of the B.T.H. Co. and manager of the Rugby Works, was introduced by Mr. E. Alexander, chairman of the Association and general superintendent of the Willesden organization. During the evening there was dancing and a cabaret.

The speaker at last week's luncheon of the **Batti-Wallahs' Society** was Mr. G. L. Schwartz, the economist, who gave an interesting address on his work in Fleet Street. Mr. A. G. Freeborn, the president, wished godspeed to Mr. W. E. Warrilow, one of the society's oldest members, who is shortly sailing for New Zealand. Mr. T. C. F. Bigland (the "Mate") announced that the annual general meeting would be held on 12th April, and that Admiral Grantham would be the guest of honour at the next luncheon, on 28th April.

OBITUARY

Mr. C. A. Clench.—The death occurred on 3rd April, at the age of fifty-nine, of Mr. Clarence Arthur Clench, M.I.Mech.E., M.Inst.F., chief generation engineer (construction), London Division, British Electricity Authority. Mr. Clench received his engineering training on power station work with the British Thomson-Houston Co., Ltd., at Rugby, and joined the London Power Co. in 1927, with whom at vesting date he was a senior constructional engineer. From 1948 to 1950 he was generation engineer (construction) with the B.E.A., following which he became chief generation engineer (construction), London Division. He was largely responsible for the London Division's construction programme for the Bankside and Deptford East stations and the Woolwich extensions.

The late Mr. C. A. Clench

Mr. G. G. Burford, M.I.E.E., M.Amer.I.E.E., deputy chief engineer of the Merseyside and North Wales Electricity Board, died on 22nd March at the age of fifty-five. Mr. Burford was educated at Emanuel School, Wandsworth Common, and received his technical training at Battersea Polytechnic, where he was awarded the Wells Gold Medal. From 1917 to 1919 he served in France. After further training with the British Thomson-Houston Co., Ltd., Electric Transmission, Ltd., and Siemens Brothers & Co., Ltd., he joined G. V. Twiss & Partners in 1926. In 1932 he became senior assistant to the chief engineer of the British Power & Light Corporation, Ltd. At vesting date he was appointed assistant chief engineer at the Merseyside and North Wales Board's headquarters, Liverpool, and became deputy chief engineer in 1952.

Mr. Robert F. Bruce, a director of the Saxonia Electrical Wire Co., Ltd., died suddenly on 23rd March whilst attending a meeting of the Greenwich Rotary Club, of which he was a past president. Mr. Bruce, who was sixty years of age, had been connected with the cable industry for over thirty years.

Mr. H. J. Chaytor, for a number of years district engineer at the Liverpool contracts office of British Insulated Callender's Construction Co., Ltd., has died at the age of seventy-four. At his retirement in June, 1940, he was district engineer at Manchester, having served forty-seven years with the company.

Mr. E. S. Anderson, a director of Austins Lifts, Ltd., has died at Gosforth, Newcastle-on-Tyne, at the age of fifty-one.

WILLS

Lt.-Col. H. H. Vost, technical sales engineer and Midland representative of the Electric Construction Co., Ltd., who died on 28th December last, left £2,692 gross (£2,559 net).

Mr. H. W. Rogers, formerly managing director of Pifco, who died on 29th December last, left £20,130 gross (£20,063 net).

Mr. F. S. Smith, chief outside testing engineer for British Insulated Callender's Construction Co., Ltd., who died on 14th September last, left £10,155 gross (£10,052 net).

SHORTAGE OF SCIENCE TEACHERS

The serious effect on industry of the shortage of science teachers in schools was the subject of a conference of educationalists and industrialists organized by the Federation of British Industries in January. A resolution passed at the conference recommended the Federation to set up a committee representative of education, industry and other employers of scientists, with the aim not only of improving the supply of science teachers to schools in the difficult years 1955 to 1960, but of seeking a permanent solution.

Following this recommendation the Federation has formed a Committee on the Shortage of Science Teachers with Dr. P. Dunsheath (chairman of the F.B.I. Education Committee) as chairman. The members include Mr. G. S. C. Lucas (B.T.H. Co., Ltd.), Mr. L. A. Pilkington (Pilkington Bros., Ltd.), Dr. B. K. Blount (Department of Scientific and Industrial Research) and Sir George Gater (chairman, Technical Personnel Committee, Ministry of Labour).

Franco-British Power Link

Proposals Discussed at the Institution of Electrical Engineers

THE discussion of the paper entitled "The Possibilities of a Cross-Channel Power Link between the British and French Supply Systems" by Messrs. D. P. Sayers, M. E. Laborde and F. J. Lane at the Institution of Electrical Engineers, particulars of which appeared in the *Electrical Review* of 2nd April, was opened by Mr. P. Ailleret (Électricité de France) who referred to the value of the collaboration between British and French engineers which the tackling of this problem had provided. In its engineering aspect the project was much more important than could be judged by its cost, which would be small compared with that invested every year in power stations in the two countries. The work involved, however, was of a different nature and the spirit of enterprise and adventure played a much bigger part in it. Estimates made over the last two years showed many causes of diversity between the two countries beyond different times of meals and work. Mechanical troubles, strikes or national festivals did not occur at the same time and the accidental nature of this diversity affected the technical risks which could be accepted on a probability basis, as was already done for many international power links on the Continent.

Larger Cables Suggested

Mr. P. J. Squire (B.E.A.) suggested that the evidence justified a larger cable than was now contemplated. Since the paper was written, figures for diversity during the past winter had become available, and showed that in spite of the cold spell which covered both England and the Continent in February the diversity had been equivalent to 500 MW, whereas the Joint Committee had assumed that only 300 MW could be relied on.

Mr. A. Rusck (Swedish State Power Board) referred to the d.c. transmission from the Swedish mainland to the island of Gotland. In a convertor station on the mainland a.c. from a 132 kV network was converted to d.c. at 100 kV to feed a single-core cable 62 miles long to Gotland, where the d.c. was converted to 30 kV a.c. The direct current returned by earth and the sea, the electrodes being placed 6 to 8 miles south of the cable shore ends to avoid corrosion. The capacity was 20 MW and might be increased to 40 MW by using a second cable. To-day ionic valves having a capacity of 10 MW were installed; the others would be added in the summer. On 7th March the first energy had been transmitted, limited to between 2,000 and 4,000 kW owing to the non-arrival of a synchronous condenser. Everything went smoothly, and on 20th March, with the arrival of the condenser, it had been hoped to go up to 10 MW, but on 19th March a cable fault occurred which had only just been put right. No troubles were experienced with the convertor stations, and if these continued to work as well, d.c. should come into the picture as the preferred solution for a cross-Channel link. Probably d.c. transmission could compete economically with a.c., besides permitting different frequencies on the British and French networks.

Dr. U. Lamm (A.S.E.A.) said that originally the idea had been to use the lead sheath of the Gotland cable as a return, but this had been abandoned because, among other reasons, a protecting sheath would have to be absolutely tight for the whole length, since one small hole in it would produce concentrated corrosion on the lead sheath. In their work on d.c. transmission, which began in 1941, they had been greatly helped by the collaboration of the State Power Board.

Mr. E. L. Davey (W. T. Glover & Co.) considered that if the cross-Channel project were started immediately it could be carried out in the summer of 1957, allowing for the manufacture of the cable. The confidence of British cable makers was shown by their putting forward firm proposals, which had now been accepted, for a similar submarine project in Canada. One basis for their confidence was that the cables and accessories recovered from the sea trials had been subjected successfully to the standard B.E.A. type tests for newly-manufactured cables.

For the Vancouver project, the maximum depth of water corresponded to an external pressure of 285 lb/in². When loosely-sheathed cable was subjected to this pressure the sheath was badly creased and the dielectric distorted, but with tightly-sheathed cable no such trouble was experienced. It was therefore decided to use the latter type. To provide a gas passage the conductor was made in the hollow duct form; the gas pressure was raised to 300 lb/in², so that it should always be superior to the external water pressure.

Mr. O. W. Titus (Canada Wire & Cable Co.) said that in the 69 kV installation for crossing the St. Lawrence river too steep a temperature gradient in the cable had been avoided by designing it for a conductor temperature much lower than that allowed for cables in duct or earth. In effect it was a compression cable, of simple construction, using an oval conductor. His company believed very strongly in the hollow-core gas-pressure cable to which Mr. Davey had referred, and had already installed one in the city of Vancouver.

Messrs. R. Laroche (S.A.C.M., France) and M. Houpgen (Forges et Ateliers de Constructions Electriques de Jeumont) spoke for the French cable makers. Mr. Laroche said that for the 132 kV system the gas-filled pre-impregnated cable should, on the basis of the tests which they had carried out, be successful, while Mr. Houpgen said that the compression cable had such good electrical characteristics that it should be suitable for any voltage for the Channel crossing. The drawback that it could be manufactured only in relatively short lengths had been overcome by the use of joints of the same diameter as the cable. Testing had been confined chiefly to sea trials, because it was felt that the mechanical problems were the most important.

Special Ship Design

Sir Gordon Radley (G.P.O.) said that both power and communication cables had one common feature, the cable ship. There were only about thirty cable ships in the world, and when building a new one, as the Post Office was thinking of doing, it should be made capable of doing as many things as possible. Some power engineers suggested that the handling of their very stiff cables would be facilitated if the cable were brought in over the bows and taken out over the stern, which suggested building a ship like an aircraft carrier, with a clear deck and all the top hamper to one side. The first joint made had taken 52 hours in all,

the next 36 and the last about 26, but the target should be a maximum of 12 hours, which was the time allowed for lifting a cable in the North Sea and connecting in a repeater.

Mr. P. R. Dunn (B.I.C.C.) gave some particulars of the Vancouver scheme, which involved about 80 miles of 138 kV pre-impregnated gas-filled submarine cable. The crossing was in two parts, of 15½ and 4 miles, divided by an island, and the maximum depth about 100 fathoms. The cable differed from that used for the Channel trials largely in having a hollow conductor to give a gas channel. In magnitude and in its technical problems the project was comparable with the cross-Channel link, but the Canadian engineers had decided to proceed with it. Mr. Dunn hoped that on this side of the Atlantic an equally progressive approach would be made.

Mr. F. W. H. Shaw (Siemens Bros.) expressed the opinion that the nearer it was possible to get to a flexible joint of uniform diameter in a submarine cable, the better were the prospects of the cable operating satisfactorily after installation.

Capacity and Costs

Mr. F. C. Winfield (Merz & McLellan) said that by 1962 the French and British systems would probably each have a generating capacity of about 30,000 MW, yet they would be tied together by a 100 MVA "shoestring." In those circumstances the control system would have to be very sensitive indeed. With d.c. about 630 MW could be got across with the four cables, and he thought that when a change was made to 275 kV d.c. would be necessary. In this country, however, we were behind Sweden in rectifier development. In the next ten years there would be an enormous demand for e.h.v. large power transmissions over long distances, and atomic energy would add to such a demand. He saw no hope of getting transmission costs down materially except by the use of d.c.

Mr. C. C. Barnes (B.E.A.) remarked that the handling and laying of h.v. submarine power cables was a practical issue which could not be adequately appreciated when making academic calculations. Submarine cable installations were complex projects having little in common with normal installations of land cables. Design data for two types of 132 kV submarine cables were given in the paper which involved maximum electrical stresses of 120 kV/cm. He knew of no land cables operating at such stresses. It was essential for these cables and their associated joints to be fully tested, and, if they were considered suitable for the cross-Channel project, a reassessment of normal 132 kV land cable practice would be necessary.

Mr. J. E. Calverley (E.E.C.) did not agree that British rectifier manufacturers were at fault, as it was no use designing and building large h.v. rectifiers if there was nowhere to try them out; there had been no opportunity for development. Swedish engineers had been fortunate in the co-operation of the Power Board. He believed that sooner or later d.c. would come into its own for the transmission of power. If the Channel at the point where it was proposed to cross it had been a little wider than 26 miles the limit of a.c. transmission at high voltage would have been reached.

Mr. A. L. Williams (B.I.C.C.), dealing with the repair of cables, said that the operations at sea were likely to occupy five days. A wind force of 5 in the Beaufort scale would mean a temporary suspension of operations, and a wind force of 6 would necessitate the ship's return to harbour. Weather statistics showed that in the best months of the year, May to July, there was an even chance of getting five days when they were wanted, but in the worst months, November and December, the odds were 9 to 1 against. The periods of repair could be split up, however, and the operations of finding and marking, making the first joint and making the second, could be separated, so there was a virtual certainty in June of completing the repair in a fortnight and in December of doing so in a month.

Mr. W. Cox (Kennedy & Donkin) described developments in the U.S.A. by the Bonneville Power Administration with a pipe-type cable in which a 10in steel pipe would be laid as a unit for about five miles at a maximum water depth of 700ft. After laying, the pipe would be filled with oil and three cores of 230 kV cable pulled into it by steel rope, the cables being held in triangular formation by roller-bearing carriages to reduce the coefficient of friction and permit pulling the cable in one continuous length; a mean oil pressure of 200 lb/sq in would be maintained. The pipes would be joined together and floated out on the water as a huge coil; the full length would be gradually uncoiled right over to the other side of the crossing. Experiments had shown that the effects of a dielectric failure would be very small.

Mr. E. W. Wardrop (City and Guilds), dealing with the control and operation of the two systems when run in parallel, suggested that if a small electrical model were made of the cable and the voltage difference between Dover and Calais controlled, a continuous record of the power flow could be transmitted to the control rooms in the two countries, thus providing a check on the mathematical work.

Mr. P. Robinson (Kennedy & Donkin) suggested that by an a.c. connection more might be lost than gained. The B.E.A. had reduced frequency to avoid cutting off consumers when the demand exceeded available plant capacity. This effect was at present 300 MW per 0·1 c/s change in frequency, and presumably would increase. That advantage would be sacrificed for the gain of 100 MW. A d.c. or frequency-conversion connection would solve the problem of the interconnection of two large systems by a weak link without forgoing too many of the advantages of running separately.

Major T. Rich thought that the development of the Kent coalfield would be of advantage to the scheme, and suggested that the use of the lignite beds of Western Germany might be considered.

Mr. J. E. Robinson (Ferranti) pointed out that the difference of £4 million in capital cost between 132 kV and 275 kV arose largely from the increased cost of land connections on the French side. This suggested that the difference was bound up not with the voltage of the submarine part of the scheme but with the availability of power on the French system in the region of the Channel.

Mr. F. J. Lane, replying to the discussion, referred to suggestions that a 100 MW connection was too small. A 400 MW connection would, however, mean connecting back to the London and Paris lines. Advocates of d.c. had not mentioned the risk of interference with navigation. Moreover, as a separate investigation under the auspices of the E.R.A., to provide the h.v. rectifiers would necessitate a development programme taking eight or nine years. D.c. transmission for a project of this kind certainly seemed to have a future, but it was only by the combined work of the manufacturers and supply authorities that the proper development could be completed.

"NALGO" Conference

Immediate and vigorous action to improve salaries was demanded at a special conference of the National and Local Government Officers' Association at the Seymour Hall, London, on 3rd April. The conference was attended by over 1,200 delegates representing members in the local government, gas, electricity, national health, and road passenger transport services in England, Scotland and Wales.

PARLIAMENTARY REPORT

IN the House of Lords last week Lord Derwent asked the Government whether the discharge of fumes from the Bankside power station was having any injurious effect upon St. Paul's Cathedral.

Lord Mancroft, Lord in Waiting, replied that the new Bankside power station was equipped with the most modern type of gas-washing plant. The performance of this plant had been under constant observation since it was put into operation last July and a high degree of efficiency had been maintained on the extraction of sulphur dioxide from the flue gases. He was advised that there was no reason to think that the small amount which passed into the atmosphere from the new power station had any harmful effect upon St. Paul's Cathedral. If, on the other hand, any evidence were advanced to the contrary, the Government would, of course, be prepared to undertake most immediate and searching investigations.

Lord Derwent asked if Lord Mancroft could give any indication as to the volume of the fumes given out by the new power station as compared with the old station.

Lord Mancroft said he understood that the new station gave out about 10 tons of fumes a month, compared with over 150 tons a month by the old station.

Speaking in the House of Commons, Mr. Hastings asked the Minister of Fuel and Power whether, in view of the limited possibilities of existing processes for ridding the flue gases of power stations of harmful sulphur oxides, he would arrange for investigation and research into this question.

Mr. Geoffrey Lloyd said that this problem was already the subject of continuous research.

Mr. Hastings asked the Minister to give the matter special attention. The present methods involved the use of large quantities of water, and the River Thames, he was informed, would be already saturated with the effluent of calcium sulphate when only two power stations were in use on its banks.

Mr. Lloyd said that Mr. Hastings was correct in saying that the limit had been reached for the Thames, owing to the effluent he mentioned. Experiments were now taking place with a new process which involved the use of gas liquor.

In reply to further questions Mr. Lloyd said that a steady decrease in fuel consumption at Barking power station was expected from now onwards and the discharge of sulphur oxides would therefore be reduced. The new part of the station would disperse its oxides at high temperature and great velocity through chimneys 375ft high. The present method of sending out the smoke at high temperature by fans at high velocity was the best practical method known to the engineers, apart from that of gas washing, which some experts considered not to be satisfactory. It was fortunate that the old "A" station—probably the cause of most of the trouble—was due for retirement soon. The new power station would go on a two-shift system of operation, instead of three, due to the general policy of concentrating electricity production as far as possible in the middle of the coalfields.

Mr. Hastings: Is it not a fact that in cases of fog these gases sent up at high velocity will descend on this area and produce all the troubles which existed in the past?

Mr. Lloyd thought that this was not so with the fogs of limited height, but it would be true with the denser fogs that grew up after a period of several continuous days.

Snowy Mountains Scheme

Mr. Robson-Brown asked the President of the Board of Trade what assistance he gave to enable British contractors to attempt to secure a substantial part in the construction of the Snowy Mountains project in Australia, expenditure on which included £40,000,000 worth of civil engineering.

Mr. Thorneycroft said that his Department kept in close touch with the contracting industry about this matter. United Kingdom companies, after careful consideration, decided not to tender for these particular contracts and further assistance from his Department was therefore not required.

East-West Trade

The President of the Board of Trade (Mr. Thorneycroft), in a statement about the discussions which had taken place with Mr. Stassen representing the United States Government and M. Maurice Schumann representing the French Government on the subject of East-West trade, said that they discussed questions affecting both the scope and the enforcement of the controls over the export of strategic goods to the countries of the Soviet bloc. They found themselves in full agreement that, while controls must be maintained on exports of goods which would add directly and significantly to the Soviet bloc's military capabilities, especially, of course, in unconventional weapons, they should seek a substantial relaxation of the controls on other goods and an expansion of civilian trade. He would emphasize that such a relaxation was fully compatible with security requirements.

On this agreed basis, they would now proceed to discuss with other friendly Governments the detailed application of this policy. Their proposal to them would be that they should examine the scope and effect of the controls, category by category, the whole operation taking two or three months. But it was their hope to introduce agreed changes by stages, and the House might be assured that they would avoid needless delay. At the same time, the House would appreciate that there could be no question of relaxing any controls except after full discussion with other friendly Governments who were equally concerned.

Electric Fishing

In reply to Mr. Janner, the Minister of Agriculture (Sir Thomas Dugdale) said that the use of electric methods of fishing was for practical purposes confined in this country to fresh waters, though experiments in the capture of sea fish were in progress. Electric fishing was used by river boards and others concerned with fishery management as a convenient and economical alternative to netting or trapping fish for restocking, artificial propagation, the removal from a fishery of unwanted species of fish, and scientific experiment. This method had not yet been used in this country to obtain fish for sale as food.

THE BUDGET

In his Budget speech on Tuesday last the Chancellor of the Exchequer said that the profits tax was expected to yield only £172 million this year, a reduction because part of last year's collection consisted of arrears of tax at the higher rate applicable up to the end of 1951. He expected E.P.L. to yield £60 million, a fall of £6 million, and surtax £132 million, approximately the same as last year. He expected £4 million more from broadcast licences.

He had decided to replace, subject to a few exceptions, the present initial allowance by an "investment allowance" which would be a tax-free allowance equal to part of the cost of an investment. It would be given in addition to the full annual depreciation allowance. The rates of the investment allowances would be 20 per cent on new buildings and machinery, new mining works and new scientific and research works, and 10 per cent for new industrial and agricultural buildings. The new scheme would come into force from that day.

Power Station Efficiencies

It is claimed that over one million tons of coal were saved in the power stations of the British Electricity Authority last year by increased efficiency of operation. The overall average thermal efficiency of the 300 or so steam stations was 23·22 per cent in 1953 compared with 22·62 per cent in 1952. The difference between these two percentages represents not only the great saving in the use of coal indicated but also an economy in operation cost of well over £3,000,000. Of nearly 60,000 million kWh of electricity sent out from the steam stations in 1953, one-quarter was provided by the 20 most efficient stations scheduled in the accompanying table, three of which for the first time in this country attained an efficiency higher than 30 per cent. These 20 stations had an average efficiency of just over 28 per cent.

STATION	Thermal Efficiency per cent
Portobello H.P., Edinburgh	30·86
Stourport "B," Worcestershire ...	30·40
Dunston "B" II, Newcastle-upon-Tyne	30·07
Littlebrook "B," Dartford, Kent ...	29·68
Bromborough, Cheshire	29·10
Skelton Grange, Leeds	28·76
BrunswickWharf, London	28·62
Braehead, Renfrew	28·61
North Tees "C," Middlesbrough ...	28·53
Battersea "B," London	28·24
Uskmouth, Newport, Mon.	28·21
Huncoat, Accrington	27·86
Poole, Dorset	27·46
Agecroft H.P., Salford	27·37
Staythorpe, Newark	26·71
Blackwall Point, London	26·63
Keadby, Scunthorpe	26·61
Stuart Street H.P., Manchester ...	26·52
Cliff Quay, Ipswich	26·49
Clyde's Mill H.P., Glasgow	26·42

Five other stations, which did not come into operation until after 1st January, 1953, but nevertheless recorded high efficiencies during the period they were working, were:

STATION	Thermal Efficiency per cent
Barking "C" H.P., London... ...	28·62
Carrington, near Manchester ...	27·83
Littlebrook "C," Dartford, Kent ...	27·65
Carmarthen Bay, Burry Port ...	27·53
Brighton "B," Sussex	27·44

B.E.A. Contracts

Contracts have been placed by the British Electricity Authority during the past month for power stations, transforming stations, and transmission lines amounting in the aggregate to £9,182,328. The principal contracts include the following:—

Bankside power station: High pressure pipework.—C. A. Parsons & Co.

Hackney power station: Circulating water works and coal handling foundations.—John Morgan (London).

Littlebrook "C" power station: Site roads and surfaced areas.—Holloway Bros. (London).

Marchwood power station: Superstructure.—Staverton Builders. 132 kV and multicore cables.—Pirelli-General Cable Works. 415 V motor contactor gear.—Brookhirst Switchgear.

East Yelland power station: Superstructure.—Staverton Builders.

Castle Donington power station: Two 830,000 lb/hr boilers.—Babcock & Wilcox. Two reinforced concrete chimneys.—J. L. Keir & Co.

Nottingham power station: Steel framework to boiler house and turbine house.—Dorman, Long & Co.

Hams Hall "C" power station: Main buildings and superstructure.—Staverton Builders. Three cooling towers.—Film Cooling Towers (1925).

Bold "A" power station: Cooling tower.—Film Cooling Towers (1925).

Ferrybridge "B" power station: Two booster and two boiler feed pumps.—Harland Engineering Co.

Keadby power station: High and low pressure pipework.—C. A. Parsons & Co.

Wakefield power station: Main building and superstructure.—M. J. Gleeson (Contractors). Circulating water pumps, pipework and valves.—W. H. Allen, Sons & Co.

Dunfermline power station: Foundations, superstructure and ancillary works.—Ivan Tait.

Barony power station: Main foundations and ancillary works.—John Laing & Son.

Two 36 MVA generator transformers.—General Electric Co.

Dalmarnock power station: Main steelwork.—Redpath Brown & Co. Five boiler feed pumps.—G. & J. Weir.

Elstree substation: Site and foundation works.—J. L. Eve Construction Co.

Wakefield substation: Site and foundation works.—M. Harrison & Co. (Leeds).

Carrington substation: Site and foundation works.—Sir Alfred McAlpine & Sons.

Kearsley substation: 132 kV 3,500 MVA switchgear.—Metropolitan-Vickers Electrical Co.

Windscale substation: Two 30 MVA 132/11 kV transformers.—C. A. Parsons & Co.

Power Factor Conference

On 25th March the South Wales Electricity Board held a conference at Swansea to discuss power factor. Some 400 of the leading industrialists in the West-Central and Western Sub-Areas of the Board attended. The conference was opened by Mr. W. A. Gallon, deputy chairman of the Board, and Mr. W. P. Warren, the Board's section head for industrial supplies, explained the advantages to be obtained by the improvement of low power factor installations. To enable the industrialists to see the equipment available for power factor correction an exhibition was staged by Philips Electrical, Ltd., S. H. Hunt (Capacitors), Ltd., Wego Condenser Co., Ltd., Telegraph Condenser Co., Ltd., Johnson & Phillips, Ltd., British Insulated Callender's Cables, Ltd., Dubilier Condenser Co. (1925), Ltd., Bryce Electric Construction Co., Ltd., Standard Telephones & Cables, Ltd., and Ferranti, Ltd.

Consulting Engineers

On Thursday of last week the Association of Consulting Engineers held its fortieth annual dinner at the Dorchester Hotel, London. The chair was taken by Sir Bruce White, this year's chairman of the Association.

After the loyal toast the Rt. Hon. L. Heathcoat-Amory, M.P., proposed the toast "The Association of Consulting Engineers." He congratulated the Association on its 40 years of successful activity. It had not only done much valuable work at home but had also concentrated on export. To-day we had to earn by our current trading as a nation and at the moment we were paying our way. Last year the United Kingdom had a surplus of £225 million on its overseas account, but in spite of this there were many causes for anxiety. We had, as a nation, barely been maintaining our share of world trade and we were having to face growing competition. Therefore, we must provide means for substantial overseas investments and increase our productivity.

The response was made by Sir Bruce White, who said that many countries favoured tenders for contracts which included both design and construction. However, it was to be hoped that these countries would eventually realize the value of the impartiality of consulting engineers.

The toast "Our Guests" was proposed by Mr. J. A. Banke, O.B.E., and H.E. Sir Claude Corea, K.B.E., High Commissioner for Ceylon, replied.

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £156 0s 0d
COPPER, H.C. Electro	ton £235 10s 0d
Fire Refined 99·70%	ton £234 0s 0d
Fire Refined 99·50%	ton £233 0s 0d
COPPER Tubes ..	lb 2s 3½d
Sheet	ton £292 0s 0d
H.C. wire and strip	ton £265 10s 0d
LEAD, English ..	ton £93 5s 0d
Foreign	ton £92 0s 0d
MERCURY	flask £73 0s 0d
TIN, block (English) ..	ton £755 0s 0d
ZINC, G.O.B. Foreign	ton £79 10s 0d
Electrolytic	ton £85 7s 6d
BRASS Tubes (solid drawn)	lb 1s 10½d
Sheet	ton £238 15s 0d
Wire	lb 2s 5½d
PHOSPHOR BRONZE Wire	lb 3s 9½d
PLATINUM	oz £30 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 17½d–17⅞d

The Ministry of Materials announces that from 6th April its selling prices for tungsten ores of standard 65 per cent grade and ordinary quality have been increased as follows:—Wolframite from 155s to 165s; Scheelite from 150s to 160s per long ton unit delivered consumers' works.

Engineering Wages Agreement

LAST WEEK at a further meeting between representatives of employers and trade unions in the engineering industry the employers offered increases in weekly wages amounting to 8s 6d in the case of skilled adult male workers, 6s 6d for unskilled men and 7s 6d for intermediate grades. The offer was accepted and took effect on Monday last. About 2½ million workers are affected and the estimated cost of the increases is put at about £50 million a year.

Mine Mechanics and Electricians

Draft regulations which it is proposed shall come into force on 1st September next have been made by the Minister of Fuel and Power requiring the appointment of mechanical engineers, and mechanics for mines and electrical engineers and electricians for mines in which electrical energy is used. Part II of the regulations (The Coal Mines (Mechanics and Electricians) General Regulations, 1954) (Stationery Office, 4d) specifies the duties of mechanics and electricians in mines and requires mine managers to ensure that schemes are in force for the systematic examination and testing of mechanical and electrical plant.

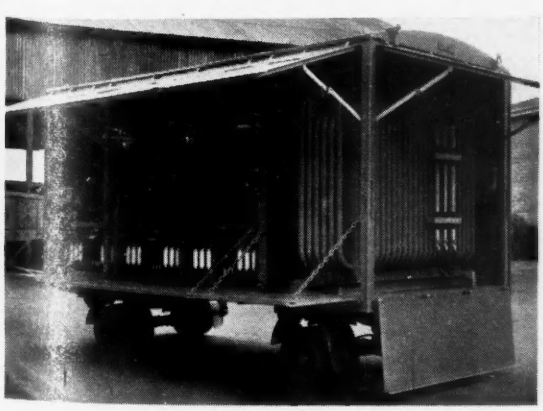
Rectifiers for the Admiralty

The Admiralty has recently ordered from the Electric Construction Co., Ltd., twelve mobile substations each having an output of 200 kW, 230 V, two-wire, d.c., 870 A. Each equipment is designed for use on a three-phase 50 c/s supply at any voltage between 380 V and 430 V, the rectifier equipments being connected to the a.c. supply by trailing cables which are fed from various supply points in the dockyard. An induction-regulator provided with each equipment is capable of giving ± 10 per cent variation on the nominal 230 V d.c. output, this voltage variation being absolutely smooth. The equipments are intended to supply d.c. power to ships when no generating plant is running in the vessels themselves.

Each equipment consists of an induction-regulator of the oil-immersed hand-operated type, a double-wound, oil-immersed rectifier transformer arranged to give a six-phase output and three mercury-arc rectifier glass bulbs connected in parallel and arranged for six-phase rectification; the bulbs are carried in special resilient-mounting cradles.

An oil-immersed, hand-operated a.c. circuit breaker is provided to control the incoming supply and a d.c. circuit breaker, with three distribution feeder circuits, is provided on the output side. The whole of the equipment is contained in a weatherproof housing mounted on a well-sprung robust chassis and provided with suitable guttering and down-spouting to collect and remove rainwater. The necessary lighting and braking accessories are included so that the trailer may be towed on public roads.

E.C.C. mobile rectifier equipment for the Admiralty



Public Speaking Competition

The Area Competition for Scotland of the E.D.A. Public Speaking Competition was held in the North British Station Hotel, Edinburgh, on 26th March. The ladies' contest was won by Miss Barbara Gillies, filing clerk in the Commercial Department at the headquarters of the South West Scotland Electricity Board, who goes forward to compete in the National final competition to be held in London on 23rd April. Second place was gained by Miss Philomena Gallacher, clerk in the Ayrshire Sub-Area office of the South West Scotland Board. The first and second places in the men's section were won by members of the staff of the South East Scotland Board. Mr. J. A. B. Maben, clerk in the Galashiels office of the Southern Sub-Area, who was second in last year's competition, gained first place and will compete in the National final. The second prize was won by Mr. P. G. Cope, assistant commercial engineer at the Board's headquarters. The judges were Mrs. M. E. C. Stewart, past-chairman of the Scottish Council, E.A.W., Mrs. W. S. Sawtell, chairman of the Edinburgh Branch, E.A.W., Mr. Abercrombie, Edinburgh University, and Mr. J. A. Stedman (E.D.A.). Mr. W. S. Sawtell, deputy chairman, South East Scotland Electricity Board, presented the prizes at the conclusion of the competition.

Bylock Appeal Succeeds

After a recent public inquiry by an inspector of the Ministry of Housing and Local Government the Minister has decided to allow the appeal of Bylock Electric, Ltd., against the refusal of the Enfield Council to permit the erection of a two-storey factory building in its area. The Council's case was that the site was included in an area scheduled for residential purposes although it would not be developed immediately. The Minister says that in general industrial expansion in London should be restrained but in this case export trade was involved and it was unreasonable to expect the site to be "sterilized" for a number of years. He would, however, "view with concern" any further extension on the site.

Radio Valve Film

"The Manufacture of Radio Valves" is the title of a new Mullard documentary film which has been specially produced for showing to engineers, technicians and students. It includes many of the factory sequences from the Mullard film "It's a Good Sign," which has already been shown to radio and television retailers in different parts of the country. However, the presentation has been specially modified to meet the needs of technical education, and a number of additional sequences have been included. The film gives clear technical descriptions of the way in which valves are made, from the raw materials to the finished product.

Locomotives for Brazil

The English Electric Co., Ltd., is supplying thirteen 1,000 h.p. diesel-electric locomotives for passenger and freight service on the metre gauge system of the Rede Ferroviara do Nordeste, formerly the Great Western of Brazil Railway. The diesel-electric power equipments are being built by the English Electric Co., Ltd., and the mechanical parts by the Vulcan Foundry. The locomotives are of the A1A-A1A type having two three-axle bogies the outer axles of which are motored. They are equipped for multiple unit operation.

The new locomotives are at present intended to run on the Central line from Recife to Afogadas de Ingazeira (250 miles), and on the Southern line to Maceio (216 miles). The locomotives will be employed principally

on the haulage of passenger trains and will also be used to assist in the movement of the heavy seasonal crops of sugar and cotton. During the last 10 years, considerable increases in passenger traffic have been recorded, the number of passenger kilometres having increased from some 163 million in 1942 to 267 million in 1951. The R.F.N. also carries about 1¼ million tons of sugar and its derivatives each year. In addition, 90,000 tons of cotton is hauled from the interior to Recife each season.

The maximum gradients on the R.F.N. are 1 in 40, and the sharpest curves are of 260ft radius. The new locomotives are able to make a return trip over either of the two lines without refuelling. A new running shed, fully equipped for heavy and light maintenance, is being provided at a point 4 miles from Recife.

Lifts for India

The General Electric Co. of India, Ltd., agents in India for the Express Lift Co., Ltd., has received an order worth approximately £60,000 to supply and install four gearless passenger lifts and one two-speed passenger-goods lift in the new building being erected for the United India Fire & General Insurance Co., Ltd., in Madras. The lifts which will be the first gearless lifts in Southern India will travel at 500ft per minute. The gearless lifts will serve fourteen floors and the passenger-goods lift, fifteen. The lift equipment will be made throughout by the Express Lift Co., Ltd., at Abbey Works, Northampton, with the exception of some specialized items such as the motor-generators, which will be made by the parent company, the General Electric Co., Ltd., at its Witton Works, Birmingham, and the tee steel guides and the steel wire ropes which will be obtained from specialist British manufacturers.

E.E. Domestic Appliance Sales

At the annual general sales meeting of the English Electric Co.'s Domestic Appliance Division held recently at Southport under the chairmanship of the general manager, Mr. H. C. Timewell, the appointment of 12 new sales representatives was announced. The new appointments will augment the existing sales force which is based regionally, and will work under five area sales managers, who will be responsible to Mr. A. M. Parkinson, in charge of the home and export sales of domestic appliances.

Tubular Steel Techniques

A new film entitled "The Tubewright" was shown in London last week by Stewarts & Lloyds, Ltd. Outlining the rapid progress made both in manufacturing techniques and in uses of tubular steel, the film stresses the fact that one of the most important aspects of steel tubes is their high strength-to-weight ratio. It demonstrates the successful application of steel tubes as structural members in bridge-building, crane jibs, materials handling equipment, etc., and records in detail the recent construction of factories with all-welded tubular steel frames, including that, last year, of Tubewrights, Ltd.'s own factory at Liverpool. Electric railway gantries, transmission and floodlighting towers, and cable drums are among the products which will be mass-produced at this factory. The film, which runs for 25 minutes, is available on loan free of charge.

Important Turkish Contract

Negotiations, recently completed in Ankara, between the Turkish Government and the English Electric Co., Ltd., and George Wimpey & Co., Ltd., have established the principles upon which a joint contract is to be drawn up for an important hydro-electric power project (combined with flood control and irrigation) at Hirfanli, on the Kizilirmak River, about 65 miles from Ankara.

A rock-filled dam, 280ft high, will be built, and a 100 MW station constructed. Preliminary estimates indicate a total expenditure of about £T90 million (£11½ million sterling). Part of the payment (about £6 million) will be in sterling, spread over a number of years.

The electrical equipment for the Hirfanli scheme will comprise four vertical Francis type 35,000 h.p., 250 r.p.m. turbines coupled to four 31,250 kVA, 11 kV alternators, four 31,250 kVA, 11/15 kV transformers, switchgear and auxiliaries. In addition, the penstocks, intake and spillway gates, discharge regulators, etc., are to be supplied as part of the contract.

Children's Cooking Competition

The first children's electric cooking competition to be organized by the South Western Electricity Board was staged by Cornwall Sub-Area at the Faraday Hall, St. Austell, on 27th March when 12 girls between the ages of 13½ and 16 years from schools in Cornwall competed in the final round.

The prizes were presented by Lady Cynthia Carew Pole, chairman of the South Western Electricity Consumers' Council and a member of the County Council. Lady Carew Pole was introduced by Mr. C. J. Hocking, the Cornwall sub-area manager. The adjudicators were Mrs. M. Pearce, senior housecraft adviser, English Electric Co., Ltd., and Miss S. O'Connor, General Electric Co., Ltd.

Works Visit

The Senior Trade Commissioner for Australia in London together with five of the Agents-General and their wives, were among a party of visitors which recently toured some of the northern factories of British Insulated Callender's Cables, Ltd. They were, Mr. G. R. B. Patterson, Senior Trade Commissioner for Australia, Mr. J. M. Tully, Agent-General for New South Wales, Sir John Lienhop, Agent-General for Victoria, Mr. D. J. Muir, Agent-General for Queensland, Mr. Howard Greenham, Agent-General and Trade Commissioner for South Australia, and Mr. J. A. Dimmitt, Agent-General for Western Australia.

The party was received by Mr. W. H. McFadzean (deputy-chairman and chief executive) and Mrs. McFadzean, who were accompanied by Mr. R. J. Hall, J.P. (director), and Mrs. Hall, and Sir Rex Hodges, J.P., formerly general manager and secretary of Mersey Docks and Harbour Board, who recently joined the board of B.I.C.C.

Driver-Harris In Spain

The British Driver-Harris Co., Ltd., has formed a new company, Driver-Harris Iberica, S.A., for the process and marketing of "Nichrome" and other nickel-containing alloys in Spain and Spanish territories. Mr. R. M. Parry, managing director of the British Driver-Harris Co., and Mr. W. F. Marsh, director in charge of production of the British company, are directors of Driver-Harris Iberica.

Catalogues and Lists

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Technical information leaflet on the new "Osram" fluorescent tube colours (7).

Nettle Accessories, Ltd., Harper Road, Wythenshawe, Manchester. — Illustrated folder covering a complete range of the company's weatherproof and watertight rubber couplers, plugs, sockets and strip light fittings.

Fawcett Preston & Co., Ltd., Bromborough, Cheshire.—Loose-leaf catalogue of industrial machinery, including heat exchangers, evaporators, coolers, etc.

Brook Motors, Ltd., Empress Works, Huddersfield.—Eight-page list illustrating "Brook" special control panels (757).

The Martin Agency, 43, London Road, Kingston on Thames.—Priced folder illustrating domestic electric tie presses, trouser presses and gas lighters.

The Magnetic Equipment Co., Ltd., Lake Works, Portchester, Hants.—Two illustrated leaflets on "Magco" magnetic chucks (35) and vibratory equipment (42).

Cambridge Instrument Co., Ltd., 13, Grosvenor Place, London, S.W.1.—Leaflet describing a series of instruments designed for locating the positions of earth faults on power cables.

Tubewrights, Limited, Egginton House, 25, Buckingham Gate, London, S.W.1.—Illustrated booklet featuring some examples of tubular equipment for use in materials handling.

Rubery, Owen & Co., Ltd., Darlaston, South Staffs.—Leaflet on a new press brake guard (148).

Trade Announcement

Following on the resignation of Mr. H. Benton, **Sunvic Controls, Ltd.,** has appointed Mr. F. N. Yates, 36a, Brownsville Road, Heaton Moor, Stockport, Ches., as its north western representative.

VIEWS on the NEWS

By REFLECTOR

SYNCHRONOUS clock makers were adversely affected by the frequency drops to which the B.E.A. had to resort in the past few winters to avoid load cuts. Although each day (or night) the frequency was run up to compensate for earlier falls the electric clock owner was never quite certain of the correct time. (Not that he is always sure when he has the average domestic spring-operated timepiece.) There was little frequency dropping during the winter now past and electric clock sales should have improved accordingly. One by-product of the maintenance of frequency is mentioned by the Post Office. There has been a decline in the use of its speaking clock system (" TIM ").

* * *

With the merging of the North Western and Merseyside and North Wales Divisions of the B.E.A. the two magazines published by these Divisions—" Beacon " and " Gridiron Gazette "—have been combined to form a new publication, " Northern Lights." One feature of " Beacon " which is retained is the question and answer section instituted by Mr. A. R. Cooper, the controller, a few months ago. In this Mr. Cooper replies to questions relating to many different aspects of the organization, some of them of a critical nature, and is able to explain a number of things that may at first appear to be inexplicable. As Mr. Cooper acknowledges, the idea has been copied from a very successful scheme operated by the Detroit Edison Co., one of the leading American electrical utilities.

* * *

A report appears in the *Wisbech Standard* of a Court order made against a man for payment of a debt to the Eastern Electricity Board of £3 4s 5d at the rate of £1 a month. The amount represented hire-purchase instalments due on a radio receiver, and this raises again a point with which I dealt three or four years ago. Is it the proper function of Electricity Boards to sell radio sets which are only obliquely domestic electrical appliances, and must necessitate a specialist repair service? Isn't it going a bit too far into the retail business?

* * *

An account is published in the Bradford *Telegraph and Argus* of trouble in which a local fruiterer is involved. One day recently when he went to pull down his sunblind he found that it would only go less than half way because a new electric light standard had been erected in front of his shop. He told the newspaper that he did not see why he should have to go to the expense of dismantling and adapting the sunblind, the implication being that the Corporation would either have to pay or remove the lamp-post. " Ancient lights " are protected by law; is there a legal obligation in the case of " ancient shades "?

* * *

In its March " Report and Newsletter " the Dartmoor Preservation Association, referring to the permission given to the B.B.C. to erect a transmitter on Hessary Tor, Devon, exclaims that " the tor has been thrown to the Philistines." The B.B.C. is enured to stone-throwing by this time but this is something on a larger scale. The Association is also angry with the South Western Electricity Board for planning to run an overhead line across open moorland, instead of installing a cable, to supply some cottages at Merrivale. It concedes that Merrivale should have electricity but condemns the Board for trying to supply it at a reasonable cost. The Association's case is not strengthened by its admission that " the whole Merrivale-Princetown approach is already a disgrace to any National Park."

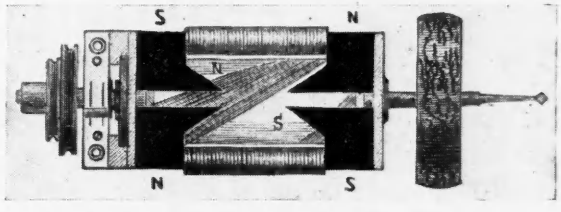
* * *

I have previously mentioned the practice of one (at least) of the Gas Boards of displaying a large notice by the side of its road excavations announcing that the work is another of its contributions to the service of the public. In the general way this is both a good advertisement and a means of mollifying road users whose progress is retarded by the operations. But when the operations become too frequent neither purpose is served. A Surbiton resident complains in the *Surrey Comet* that in one road in his neighbourhood the Gas Board has dug six or seven holes in a fortnight and filled them in again. Apparently this is the second time he has drawn attention to similar happenings and he is getting to dislike the Board. I cannot be certain that Electricity Boards are altogether innocent of such doings and I quote this example as a warning.

* * *

My regular search for interesting items from past issues of this journal has brought to light the following 70-year-old description of Irish's electric motor, an early form of fractional h.p. machine (*Electrical Review*, 12th April, 1884):—

" This motor has been devised, we are informed, in consequence of the demand for small and effective portable motors. The illustration represents a convenient form for domestic and other uses, where small power only is required, and it is fitted with universal tool holder for brushes, emery wheels, drills, &c., also sheaves and friction wheel. Although a hand machine, it may be easily clamped to the bench or table. The field-magnets



are simply electro-magnets, with their pole-pieces projecting inwards and hollowed to receive the armature. The ends of the magnets are coupled together by brass plates, which also form the bearings for the armature. The field-magnets are connected up so that their respective ends come together of different polarity. The armature is of simple Siemens' form, but with a twist, which brings one pole opposite N, N, the other pole opposite S, S. The machine is said to act well as a dynamo."

ELECTRICAL SALESMANSHIP

Practical Papers at the E.D.A. Conference

A FOUR-DAY conference which ends to-day has been taking place this week at the Caxton Hall, Westminster, and the Connaught Rooms under the auspices of the British Electrical Development Association. The official opening on Tuesday was by Sir Henry Self, president of the Association, with Dame Caroline Haslett (chairman) presiding.

Organizing Sales and Service

Under the chairmanship of Mr. H. J. Randall (chairman, London Electricity Board) the rest of the Tuesday morning session was occupied by the reading and discussion of a paper on " The Organization of Sales and Service to the Consumer " by Mr. J. Gogan, chief commercial officer, S.W. Scotland Electricity Board.

Deprecating the belief in some quarters that electricity would " sell itself," Mr. Gogan asserted that the future of the industry would depend on wise planning and organizing, on overwhelming its competitors and political opponents, and on the special brand of hard work which only enthusiasm could engender. He paid a tribute to the work which the Electrical Development Association had been doing unobtrusively but powerfully for many years and expressed the conviction that its influence would become an increasingly important component in the industry's success.

With Area Boards now trying hard to sell more electricity, it was timely to stress that everyone who got his living from the industry should endeavour to further the use of electricity among his own circle of friends and neighbours. It was a reproach to many that, being themselves only lukewarm consumers, they were unlikely to sell the electrical idea by their example.

In view of the importance of selling, it was strange how little care had been taken in the recruitment of the sales staff. Many were in their present jobs by chance of circumstance rather than through ambition for a sales career. New entrants should be subjected to a far more exacting scrutiny and a comprehensive register of all sales staff should be kept on, say, an Area basis. The register should record the staff's history, sales ability and accomplishments. The problem of incentives should also be tackled soon or they would lose some of their best people. It was an unconvincing salesman who tried to sell appliances he himself had never used, and it should be made easy for sales representatives and service centre assistants to obtain the latest equipment, either on free loan or at a nominal hire charge.

Dealing with maintenance and repair facilities, Mr. Gogan said that the efficient and pleasant mannered service man could accomplish much in fostering good consumer relations, a fact which was not always given the attention that it deserved. These men should be " hand-picked " and encouraged to realize the full implications of their job. The S.W. Scotland Board had recently started a maintenance scheme for cookers and wash-boilers installed by local authorities at an inclusive annual charge and it was hoped that this arrangement would be a decisive factor in the hard struggle with local authorities for cooker business.

Electricity Sales Considerations

The afternoon session was presided over by Mr. J. S. Pickles (chairman of the S.W. Scotland Electricity Board) and Mr. R. E. Gamlen (South Eastern Electricity Board) read a paper on " Selling Electricity: Some Commercial Considerations."

Mr. Gamlen commenced with a review of the early days of the electricity supply industry, when the selling of appliances took second place to the selling of electricity. Attempts were still being made to justify independent merchandising, but those who generated and distributed electricity should retain the ability to exert some influence on the sale of goods which went to load the mains. The growth of the supply must be orderly and those concerned with its development and management must be left in control of a substantial part of it. Even to-day many untested and shoddy appliances were being sold and too many non-standard plugs and sockets were being installed for use in conjunction with them.

It was on the ability to distribute electricity at a reasonable cost that the industry depended and too lavish expenditure on mains which would be unremunerative for years, too much administration, too few records of previous experience, too few salesmen, etc., would sooner or later add to the cost of the unit and store up future difficulties. Mr. Gamlen dealt with the proper use of showrooms, efficient stock control, and the encouragement of proficiency in showrooms by competitions.

The sale of electrical merchandise was, after all, only a means to an end, the placing into the hands of the people the means by which they could obtain all the benefits of electricity. Actual sales depended on the salesman, and the best advertising and showrooms and most attractive hire-purchase terms would be of limited value if those in the front line sales force were not keen on the job and if they did not pull their weight with the rest of the team.

Later, after tea, there was a film programme.

Training Commercial Staff

Mr. D. Bellamy (chairman, Yorkshire Electricity Board) took the chair at Wednesday morning's session when Mr. A. G. Beverstock (Southern Electricity Board) presented a paper on " Training Commercial Staff," supported by Mr. W. B. Poulter (chief commercial officer, S.E.B.)

After a brief examination of the general functions of industrial education, Mr. Beverstock referred to the importance of apprenticeship schemes. Dealing with the training of commercial staff, he said that there was one common factor which should run through all educational activities concerned with the commercial department—service to the consumer. It was a prerequisite of efficient consumer service that the confidence and goodwill of the employee should be secured; hence the importance in all training activities and in the general education policy of a Board of developing such qualities. Training in relations with the public and salesmanship required special emphasis in the case of commercial staff. The commercial department relied for its efficiency, and a large portion of its income, upon the skilled work of its contracting sections. Therefore one of the most important features of development in training since nationalization had been the introduction of the indentured apprenticeship scheme for the training of electricians. The commercial department was composed of groups of employees scattered over a large area, and adequate training for the supervisor was also of great importance.

Discussing the various techniques used for the training of the main grades of commercial staff, Mr. Beverstock referred to the regular courses and conferences being arranged within Boards, which could take the form of progressive and continuous courses at Sub-Areas, *ad hoc* courses at selected centres or regular courses at a central training centre. Courses in salesmanship provided in technical colleges were not suited to the commercial work of the electricity supply industry and the E.D.A. courses were the most satisfactory ones available at present. The domestic electricity salesmanship course of six months duration was the most popular and to date some 2,600 certificates had been issued.

With the lifting of restrictions, the way was clear for a more vigorous approach to the question of sales training. The present standard in shops and stores was low, and an attempt should be made in electricity showrooms to rise well above the general level. The applications of electricity were now so extensive and developments so rapid that courses to enable senior officers to keep abreast of new ideas might be arranged. Consideration might be given to ways by which a closer link could be formed between the educational work of E.D.A. and that of the Area Boards.

Floor Warming

" Electric Floor Warming " was the subject of a paper by Mr. J. W. Moule (chief commercial officer, S.E. Scotland Electricity Board) at the afternoon session, when Mr. V. W. Dale, director and secretary of E.D.A., presided.

Floor warming, in Mr. Moule's opinion, was the most satisfactory form of heating from the point of view of comfort and was the most efficient in that air temperatures were kept to the minimum. It was a promising way of developing the off-peak load and where it was adopted there was an added inducement to install electric storage water heaters as well.

Suitable off-peak tariffs were necessary and in S.E. Scotland the Board had obtained a useful floor warming load with a low voltage tariff of 0·475d/kWh based on a coal cost of 38s a ton, the bulk supply running charge at the time being 0·33d/kWh on the same basis. The minimum number of hours during which a supply was necessary depended, of course, on the thermal storage properties of the floor. With large buildings the floor was generally thick enough to permit a cut-off period from 7 a.m. to 7 p.m., and it was the Board's standard practice to adopt this period in such cases, although the loading had to be higher than if a mid-day boost were allowed. It was likely that they would have second thoughts on this, but experience had shown that, with only a night-time supply, there was no difficulty in maintaining sufficient heat even in the coldest weather. With lighter buildings, such as ordinary dwellings, a mid-day boost was desirable and a suitable tariff should be offered.

Although floor warming could not respond to fluctuating weather conditions as rapidly as direct electric heating, it had the important advantage that the heat was stored at a comparatively low temperature (to prevent discomfort to the feet the floor temperature should not exceed 73 deg F). If the temperature of the building began to approach that of the floor, heat emission from the floor rapidly diminished and less electricity was used during the following night to replenish the store of heat. Experiments had shown that a wide range of floor coverings could be used successfully with heated floors.

In the section of the paper dealing with costs it was stated that because the boiler, boiler-house, pipework, etc., were dispensed with the capital cost of the average " Panelec " installation was only about two-thirds of that of the ordinary central heating system. Where the owners were prepared to accept a heating cable buried solid in the floor (in the " Panelec " system the cables are installed in D-shaped metal housings laid in parallel lines across the floor) the cost could be reduced. In this connection Mr. Moule referred to an installation employing Pyrotenax cable recently carried out at Orpington by the West Kent District, South Eastern Electricity Board.

Tabulated costs for a " Panelec " installation (outside design temperature 28 deg F; connected load 69 kW) indicated that the annual operating costs for a heating season of 210 days would be £458, including £121 capital charges, £10 maintenance and £327 for 110,000 kWh at 0·7135d/kWh.

Assisting the Industrialist

A paper on " Electricity for Productivity: Selling the Idea to the Industrialist " was presented by Mr. J. R. Anderson (Midlands Electricity Board) on Thursday morning. Mr. S. F. Steward (chairman, South Western Electricity Board) was in the chair.

Mr. Anderson pointed out that he was not attempting to show how electricity could increase industrial productivity; his aim was to suggest ways in which the electricity supply industry could bring the productive advantages of electricity to the knowledge of industrialists and interest and assist them in the introduction of modern productive techniques in their works.

He first considered the types of industrial consumer from large national combines to one-man businesses and suggested which individual in each case should be " cultivated." It was then necessary for the sales engineer to know what applications were likely to interest a particular trade or industry and in an appendix the author gave a number of examples of processes and the industries in which they could be used. Methods of establishing contact were next detailed: they included " cold " canvassing, canvassing following a letter, direct mail, selective appointments, exhibitions, advertising and " leads " through the supply authority's own staff.

In the author's view two classes of staff were required—industrial sales staff and industrial applications specialist staff. The first should be able to handle general inquiries, tariffs, etc., and establish the consumers' confidence in the Board. The personal and technical attributes required in industrial sales engineers were specified.

Every Area Board interested in industrial load development should establish a specialist staff capable of advising consumers on specific applications as, for instance, mechanical handling, welding, h.f. heating, electronics, machine tools, ceramics and lighting. Stress was laid on the proper payment of these specialists and the desirability of industrial sales staff being members of the I.E.E. and other technical organizations.

Eventually the manufacturer of the appropriate equipment must be introduced to the consumer. He should be properly " briefed " and, if possible, should have some concrete proposal to make. Then the Board's staff could take a back seat, but it was still important to maintain interest in the job and contact with the consumer.

Electronics in Industry

On Thursday afternoon, with Mr. H. H. Mullens (chairman, North Eastern Electricity Board) in the chair, Mr. W. P. Warren (South Wales Electricity Board) dealt with " The Scope of Electronics in Industry."

Much of Mr. Warren's paper was devoted to a review of electronic devices and their applications. Electronics was defined as " that branch of electrical engineering which covers the control and conduction of electrical energy in a gaseous atmosphere or vacuum." The transistor might

eventually make it necessary to introduce a new terminology, or alter existing definitions, but even so the development and application of this device would be so related to present electronic techniques that the staff should find no difficulty in embracing these advances.

Dealing with staff appointments, the author drew attention to the need for training industrial electronic technicians. In engaging additional staff it had been found impossible to obtain "ready made" industrial electronic technicians and experience had shown that the best thing was to employ persons with sound light-current and radio knowledge. Where no new staff had been engaged, several industrialists had been able to choose someone from their normal electrical maintenance staff who was interested in radio and delegate to him the responsibility for electronic maintenance. In many large industrial organizations it was sometimes difficult to impress upon higher management and personnel officers when appointing maintenance electronic technicians the need to engage persons having radio experience. In some instances those with the best qualifications might have their chances of appointment prejudiced by not belonging to the appropriate union.

Mr. Warren suggested that it would be advantageous if Electricity Boards provided a maintenance and repair service for those consumers whose electronic installations did not justify the appointment of specialist technicians.

* * *

At the Connaught Rooms this (Friday) morning Mr. Dale is presiding over a general discussion and afterwards Dame Caroline Haslett will take the chair at the Conference luncheon.

Management Training

Methods Adopted in the Electricity Supply Industry

TWO outstanding contemporary trends in management training were stressed by Mr. D. Cleghorn-Thomson, director of welfare, British Electricity Authority, in a lecture to the Institute of Public Administration on 29th March. The first was the growing emphasis on social skills and the second—one of technique—was the replacement of factual lectures and questions by syndicates, group discussions, and case studies.

The British Electricity Authority, said Mr. Cleghorn-Thomson, relied for the training of its managerial grades on technical colleges, on the universities, and on special studies like those sponsored by the British Institute of Management; but at the same time the Authority added its own courses, such as factual instruction for such grades as power station superintendents or the three-week residential courses for "middle management."

The training courses for power station superintendents served three purposes. There were week-end courses designed to show them their duties as chairmen of local advisory committees; there was special induction training in the functions of the various non-engineering departments—secretary's, accountant's, welfare, etc.; and, finally, all newly appointed superintendents spent a month at headquarters in London before going to their jobs.

The speaker devoted most of his address to the residential courses for middle managerial grades, of which three had so far been held at Electricity Hall, Buxton. The students, numbering 18 in each course, were such people as divisional accountants, secretaries, chief generating or technical engineers or their chief assistants, establishment officers, etc. Students were intended to be of the "promotable" type with a fair ratio between engineering and non-engineering.

This, said the lecturer, required each department to assess its promotion needs, for nothing was so depressing as to be selected for a management training course and then be left out on a limb with no sign of promotion coming. Nevertheless, candidates were never told that they would be promoted at once. The analysis of foreseeable promotion needs might naturally modify the theoretical need to maintain a fair ratio among the students between engineering and non-engineering candidates. As the courses continued and the senior grades now in service were "used up," it would become necessary to include more factual instruction and less "syndicate" discussion.

Groups of visitors, specialists in their subjects, went to the courses for a day at a time and set the courses on the right lines.

Then there were so-called "panel members" who attended meetings at which the members of syndicates presented their findings in their own field of study to the whole of the members of the course. These might be people associated with the Authority or others with some special branch of knowledge. Finally among the training personnel there were regular specialists who provided instruction in speaking and writing for management purposes.

The first week was devoted to instruction and practice in speaking and writing. A reading project was given: each syndicate was required to distil the essentials of some long document such as a report by one of the Anglo-American productivity teams or the Government report on the age of retirement. At the end of the week the syndicates met and the chairman and secretary of each reported what their syndicate thought of the document studied, and general discussion ensued.

During the second and third weeks, three projects were introduced simultaneously. One dealt with human relations, involving an examination, for instance, of questions affecting morale in industry, or recruitment, training, promotion, incentives and staff welfare. Another project would be technical—e.g., a national fuel policy; the chairman would be a non-engineering officer and the secretary an engineer. The third project would be of a financial or administrative character such as budgetary control or depreciation of assets. The chairman of this would be an engineer and the secretary non-engineering. The principle of thus mixing the types and giving each a leading role in studying problems outside his own immediate experience was implicit throughout the course.

The whole course was conducted at a rapid tempo in the belief that that accorded with conditions of actual life. Projects overlapped and the tasks set were impossible of individual achievement so that devolution and allocation of duties were essential. The social aspects of the course were important and could only be achieved on a residential footing which mixed the various grades, made them realize the whole pattern of the Authority, and produced a more balanced and co-operative outlook on human relations and general policy.

NEW ELECTRICAL EQUIPMENT

Xenon Rectifiers

TWO INERT-GAS-FILLED rectifiers, types RR3–250/3B28 and RR3–1250/4B32, have been introduced by MULLARD, LTD., Century House, Shaftesbury Avenue, London, W.C.2, for use in the high-tension supplies of radio transmitters and similar equipment. Unlike mercury vapour rectifiers, they will operate over a wide ambient temperature range (−55 deg C to +75 deg C), and they may be mounted in any position. The valve heating time is short, 10 and 30 sec respectively, as opposed to about 15 min for mercury vapour rectifiers. These characteristics, coupled with comparatively small size and light weight, make the rectifiers particularly suitable for operation under the arduous conditions to which Services equipment may be subjected. The RR3–250/3B28 and RR3–1250/4B32 are direct replacements of American types 3B28 and 4B32, and on this account should be of interest to designers of equipment for the export market.

In a single-phase full-wave circuit a pair of RR3–250's are capable of an output of 0·5 A at 3,200 V. Two RR3–1250's, under the same conditions, have full load ratings of 3,200 V at 2·5 A. The RR3–250 has a medium 4-pin bayonet base, and the RR3–1250 a B4F base. Filament ratings are 2·5 V at 5 A and 5 V at 7·1 A respectively. The RR3–250/3B28 can be supplied to specification CV1835 and the RR3–1250/4B32 to specification CV2518.

Street Lighting Lanterns

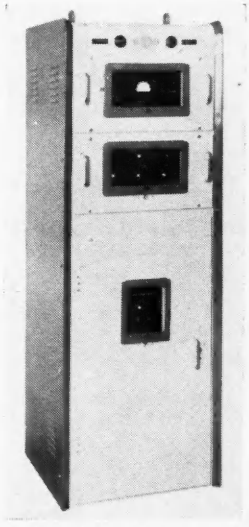
Three fluorescent street lighting lanterns recently added to the range manufactured by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, are designed for wall mounting at a height of about 25ft, spaced 50–60ft apart. The lanterns accommodate respectively one 5ft 80 W tube (Z8180), two 5ft 80 W tubes (Z8280) and two 2ft 40 W tubes (Z8240). The lanterns can be rotated on brackets to control the main beam.

Each lantern body consists of an aluminium girder framework covered with aluminium sheeting which has a weathering finish. A detachable tray within the body carries the auxiliary gear. They are enclosed by a hinged door, glazed with broad reeded glass and secured when closed by stainless steel catches. A rubber gasket ensures a weatherproof seal when closed. The reflectors, which are removable, are anodized aluminium polished and brightened.

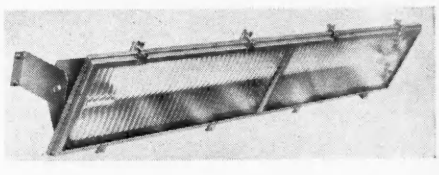
Welding Control Equipment

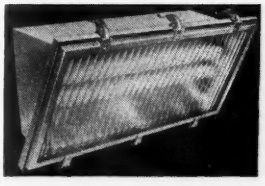
The introduction of a new range of welding cubicles is announced by LANCASHIRE DYNAMO ELECTRONIC PRODUCTS, LTD., Rugeley, Staffs. The top two panels are of sliding tray construction and house the automatic current regulator and timer respectively. The thyratron firing circuit is a standard plug-in unit and this together with the ignitron contactor is located in the lower half, access being gained from both front and rear.

The automatic r.m.s. current regulator will hold the weld current to within ± 1 per cent for a ± 10 per cent supply voltage variation. For a 2 : 1 change in load the current can be held to better than 3 per cent of the pre-set value. A feature of the unit is a device which enables a given set of conditions to be "remembered" for a period of up to 15 seconds, thus ensuring that successive welds are uniform. All main controls are protected by "Perspex" covers fitted with locks to prevent unauthorized access. Normally suitable for use on a 380/440 V single-phase supply the units are available in several forms.



Typical Lancashire Dynamo resistance welding control cubicle





The G.E.C. Z8180 (left) and Z8240 street lighting lanterns

Heated Mattresses

"Slumberland" mattresses made by SLUMBERLAND, LTD., 20, St. Ann's Crescent, London, S.W.18, are now available fitted with thermostatically controlled heating elements. Three heat positions are provided, with loadings of 34 W, 60 W and 135 W for the double-bed size and 30 W, 40 W and 86 W in the single-bed size. Maximum temperature is reached in about two hours but nearly half the temperature rise occurs in the first 30–40 minutes. The thermostatic control ensures that the temperature does not exceed 50 deg F above normal bedroom temperature. The wiring is protected from spilt liquids. The price of the double size is £5 5s extra and of the single size £4 4s extra to the normal list prices of unheated types.

Wringerless Washer

It is announced by HOOVER, LTD., 221/213, Regent Street, London, W.1, that their standard washing machine is soon to be marketed without the wringer, for those who already have separate wringers. The new wringerless machine is claimed to be the cheapest on the market and retails at £21 plus £7 17s 6d purchase tax in the United Kingdom.

Water Heaters

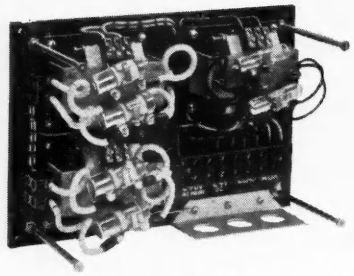
The latest addition to the "Creda" range of water heating equipment announced by the SIMPLEX ELECTRIC CO., LTD., Broadwell, Oldbury, Birmingham, is the "Creda Contour" water heater. Available in two sizes, 1½ gal and 2½ gal, they are designed for wall

"Creda Contour" water heater

mounting and are for use when a constant supply of hot water is required at only one point. The inner water container is of heavy-gauge copper and the outer casing, constructed of sheet steel, with stoved rust-resisting undercoat, has a high-gloss synthetic enamel finish in a range of colours including white, cream, pastel green and pastel blue. Taps, etc., are finished in heavy chromium plate. The loadings are 750 W (CC15) and 1 kW (CC25).

Mains Failure Unit

The mains failure unit made by ENGEL & GIBBS, LTD., Warwick Road, Boreham Wood, Herts., was originally designed for use with diesel-alternator sets in which the load was to be automatically transferred to an auxiliary source of supply upon a mains failure. Some diesel-alternators employ "on-demand" schemes in which the equipment starts up when a load is switched on and shuts down when the last load is switched off. The unit is suitable for these schemes as the coils are energized from the starter battery and impose no load on the starting relay. This will prevent false starting on "no-load" condition, upon mains failure.



Engel & Gibbs mains failure unit

The two main contactors are interlocked by timing switches in each direction ensuring that one supply is disconnected before the other is switched on. Another feature is that the relays employed are of the two coil type and, therefore, 240 V units can be adapted for 115 V operation by changing the coil tapping. The same applies to the battery system which can be 12 V or 24 V. Although primarily designed for rotary standby equipment, by rearrangement of the wiring and the coils, this is a most useful mains failure unit for switching on a second static source of supply.

Turbine Lubricating Oil Purifiers

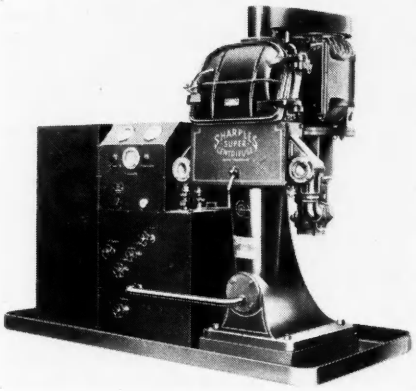
To meet the requirements of power stations for a turbine lubricating oil purifier designed specifically for that purpose and incorporating an indirect type oil heater, SHARPLES CENTRIFUGES, LTD., Tower House, Woodchester, Stroud, Glos, have developed two new types of installation.

The new Sharples Series "S" purifier is the standard model where economy in first cost is important. The heater controls and motor starter are panel mounted, but the pressure gauge, oil thermometer and valves are mounted directly on the pipework. It is considered that this model is suited to the majority of applications.

The Sharples Series "D" installation (illustrated) is for mounting on the turbine floor in circumstances where a particularly elegant appearance is the first consideration. In this model all the controls and instruments are grouped together on a flush fitted panel giving an overall appearance in keeping with the most modern turbine room layout.

Both are based on the Sharples tubular bowl supercentrifuge and the general layout of the units has been designed to conform with modern standards of power station practice, appearance and ease of cleaning.

Sharples Series "D" turbine lubricating oil purifier showing built-in indirect type heater



DOMESTIC SWITCHGEAR

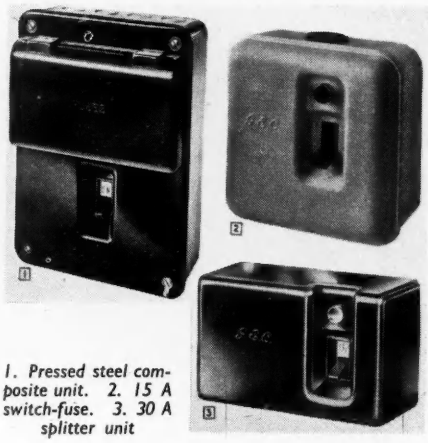
A NEW range of domestic switchgear, known as the DW range, has just been introduced by the General Electric Co., Ltd. It includes switch fuses, splitter units and composite units, suitable for use in houses, flats, restaurants, hotels, schools, etc. The units are of pleasing appearance and are in keeping with modern decorative schemes for the home, so that they do not have to be concealed.

The switch fuses and splitters are available in pressed steel cases which are stove enamelled cream, or in all-insulated cases, moulded in brown "Bakelite" material. In these units the switch is operated by a dolly which projects into a protective recess in the front cover, and it is held positively in both the open and closed positions by a spring and cam mechanism. A coloured indicator shows whether it is "on" or "off." The switch interlocks with the cover and this cannot be removed with the switch "on," or the switch operated when the cover is off. The moving switch blades are tipped with silver and the connections from the switch to the fuse rest in deep recesses in the back of the base. The metal-cased units are provided with earthing arrangements for inside and outside connections, with terminals for the main earth and separate earth connections for each fused circuit. They are available with either a s.p. 15 A or s.p. 30 A fuse. Two s.p. 15 A fuses are housed in the 21 A splitter unit and three s.p. 15 A fuses in the 30 A splitter unit. Neutral connectors are provided in all cases.

The composite units have pressed steel cases, stove enamelled cream, and the switches are similar in construction and operation to those used in the switch fuses and splitter units. A hinged lid provides easy access to the fuses, which are mounted side by side on insulated bars, a separate fuse base being used for each fuse. The main cover can only be removed with the aid of a tool.

The 60 A composite unit is available in two sizes, the smaller for 4 or 5 ways, the larger for 6 or 8 ways.

The new switchgear has been designed for voltages up to 250 V a.c. and prices range from 8s 4d for a 15 A switch fuse with moulded case to £4 10s for a 60 A composite unit.



1. Pressed steel composite unit. 2. 15 A switch-fuse. 3. 30 A splitter unit

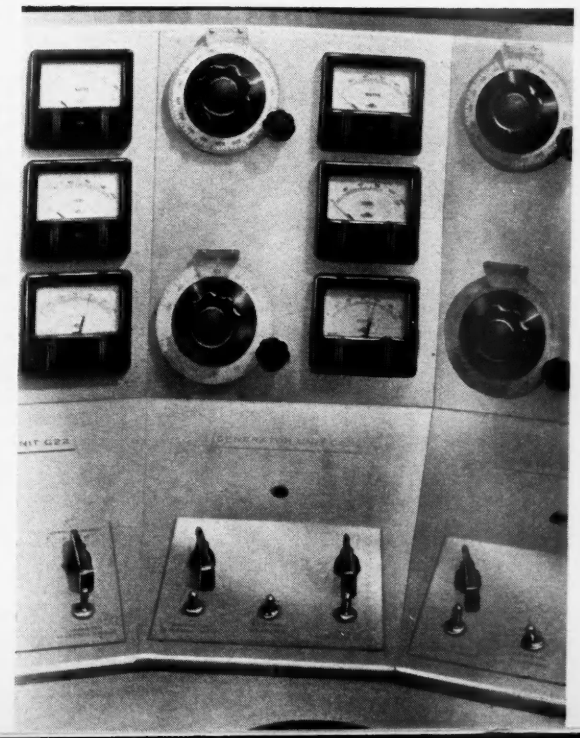
Supply Network Analysing

IMPEDANCE TYPE SYSTEM

THIS article describes a supply network analyser which has been developed and recently introduced by A. Reyrolle & Co., Ltd. The system is of the impedance type and follows conventional lines except for the operating frequency, which is 1,592 c/s instead of the more usual 500 c/s, and for differences in the design and connection of the units which arise out of this. The main purpose for which this analyser has been developed is the study of power system problems such as voltage regulation, load distribution, synchronous stability, and fault calculations, but, as with most analysers, physical and mechanical problems can also be dealt with when it is possible to construct an equivalent electrical analogue for these problems. The system can also serve for such transient studies as rates-of-rise of restriking voltage.

Incorporated in the equipment are 12 generator units, 120 line units, 36 load units, 36 auto-transformer units, and 72 capacitor units. Sixteen of the thirty-six load units have built-in auto-transformers and each load unit has a load voltmeter. These units, with the exception of the generator units, are arranged in four groups, each of which is associated with a marshalling cubicle or plug board at which the appropriate connections between the units are made. The twelve generator units may be switched to any of the four marshalling cubicles and there inserted into the system as required by the problem. All main metering is done from the control desk upon which there are five master instruments, namely, an ammeter, a voltmeter, a wattmeter, a varmeter, and a phase-angle indicator. These are connected to any part of the system being studied by means of a metering selector system operated from the control desk.

The main source of supply to the analyser is a valve-maintained tuning fork which produces an accurately controlled voltage at 1,592 c/s. This single-phase source is fed into a phase-splitting device to give a two-phase supply which is fed into twelve continuously-variable phase-shift devices, the single-phase outputs of which are fed into continuously-variable voltage transformers. Thus at the terminals of the voltage transformers there are twelve sources of supply of variable phase and magnitude. These sources are fed into output amplifiers of special design



Above: The analysing system; impedance units and marshalling cubicles in background and generator, etc., on control desk in foreground

Right: Some of the generator controls

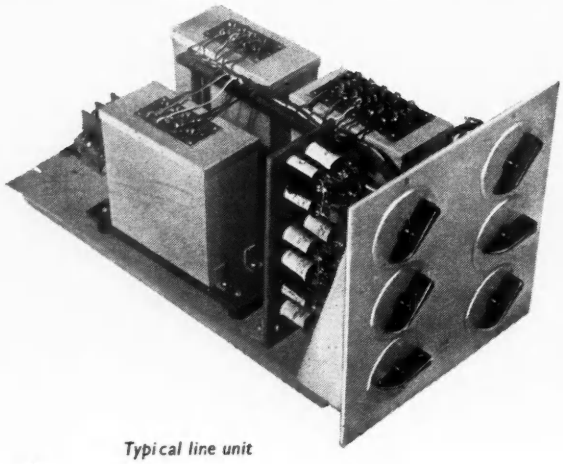
and very low output impedance, and from these into the generator impedance units. The output amplifiers and their associated impedance units are mounted in the centre of the analyser.

The connections from the twelve generator impedance units are taken via selector switches to one or other of the marshalling cubicles. Each unit has its own monitoring wattmeter, voltmeter, and varmeter alongside the phase-angle and voltage controls.

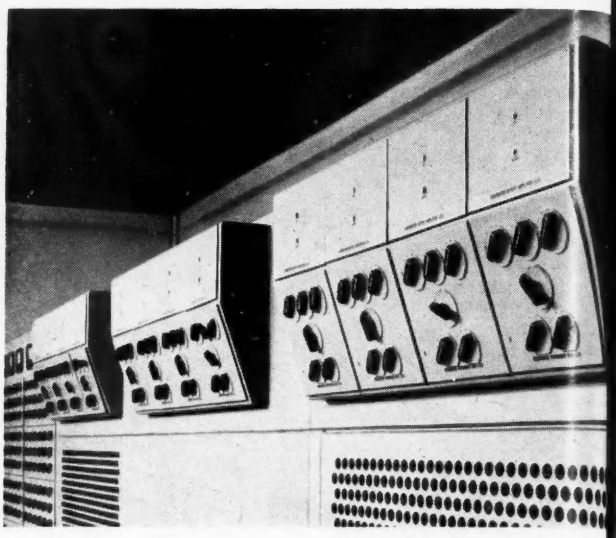
Other components of the equipment are: line units consisting of adjustable inductance and series resistance; capacitor units which can be either series or shunt connected and can represent line or cable capacitance, synchronous condensers, or bulk capacitors; load units consisting of resistance and inductance for shunt connection; and auto-transformer units which are used to simulate tap-changing operations. The various units terminate in flexible leads and three-pin plugs at a plug board and the plugs can be inserted into the sockets of a marshalling board. In order to interconnect two units their plugs are inserted into adjacent sockets. A row of plugs in adjacent sockets represents a busbar. Two pins of the plug are connected to the unit, and the third illuminates a lamp on a mimic diagram appropriate to the socket in which the plug has been placed. Correct plugging is indicated by the dimming of the lamps associated with the unit when this is selected on the metering selector panel.

On the control desk are twelve sets of generator monitoring instruments with independent phase-angle and amplitude controls; also five master instruments, namely, the voltmeter, ammeter, wattmeter, varmeter and phase-angle indicator mounted in the centre of the desk. These are air-cored dynamometer instruments with light-spot indication. The phase-angle indicator, which is mounted at the right-hand front of the desk, is a cathode-ray tube with a scale marked in degrees on its screen. Indication is by "pips" on a circle showing the phase relationship of voltage and current of any unit being metered with respect to each other or to some arbitrary reference. The instrument is also used as a waveform monitor. On one panel of the desk are accommodated controls for the metering selection and range change for the master instruments. Each unit of the analyser is identified by a three-digit number and the master meters may be connected to any unit by pressing out the appropriate unit number on the selector panel. Thus, once having set up the system and adjusted unit values, the operator is able to determine all required electrical quantities throughout the system.

When setting up a problem it is first necessary to mark on a system diagram all the relevant voltages, equipment



Typical line unit



Output amplifiers and generator impedance units

ratings and impedances of components. These data are then used to draw a schematic system diagram on translucent paper which is placed on the mimic diagram table and registers with the indicating lamps. The units to be used in the study are adjusted to the required values, and are plugged upon the marshalling boards. The operator then takes readings of all electrical quantities throughout the system and a second operator logs them on the schematic system diagram.

Rationalized M.K.S. System

A COURSE on "Electrical Units and Measurements, with particular reference to the Rationalized Metre-Kilogram-Second System," was held at the University of Bristol from 2nd to 4th April. About 70 attended, including lecturers from universities, technical and training colleges, H.M. Inspectors of Schools, engineers from industry, instructor officers from the Royal Navy and the Army, and masters and mistresses from a wide range of schools. The lecturers were Dr. W. J. Bates, Mr. R. L. Russell and Professor G. H. Rawcliffe.

During the past few years, following the official recognition of the rationalized M.K.S. system by such bodies as the Institution of Electrical Engineers, the use of this system has been rapidly on the increase, and the course served both as a refresher on electrical units in general and as an introduction to the use of the rationalized M.K.S. system. This system has been officially supported by the International Electrotechnical Commission since 1935, and is very widely used in the United States.

During the afternoon of 3rd April the visitors toured the Physics Department and the large new building for the Faculty of Engineering now approaching completion. The course was organized by the Regional Council for Further Education in the South-West, in conjunction with the Bristol Education Committee, and the visitors were welcomed at dinner in Wills Hall by the Vice-Chancellor of the University, Sir Philip Morris.

Permeability Determination

THE British Standards Institution has recently published B.S. 2454 : 1954, which deals with the determination of the normal magnetization curve connecting flux density and magnetizing field of iron and steel (other than permanent magnet materials) in the form of bars, forgings and castings. Copies are obtainable from the British Standards Institution, 2, Park Street, London, W.1, price 2s 6d.

Supervising Electrical Engineers

Association's Annual Dinner and Reunion

THE annual dinner of the Association of Supervising Electrical Engineers was held on 2nd April, the president, Mr. C. T. Melling (chairman, Eastern Electricity Board), taking the chair. Apart from the loyal toast, there were only those to the electrical industry and to the guests and speeches were short, albeit amusingly anecdotal, in order to allow ample time for the subsequent reunion. The first of the two toasts was proposed by Sir Miles Thomas (chairman, British Overseas Airways Corporation), who referred appreciatively to the recognition of the Association by the Institution of Electrical Engineers as the representative body for technicians. The scope for electricity, in industry and in improving standards of living, he said, would depend very largely upon the avoidance of power cuts and upon research activities.

Responses were made by Mr. H. Bishop (President, Institution of Electrical Engineers) and Mr. J. Flood (national chairman, A.S.E.E.). Mr. Bishop said that all had reason to be proud of the achievements of the B.O.A.C. and he congratulated Sir Miles Thomas on its having earned a profit in 1953, which had also been a good year in regard to the equipment of factories at home and in the amount of exports by which this country lived. The I.E.E. was more than a learned society. It could also give practical help to the Association as the body representing technicians. Recruitment was not enough, however, as young people needed appropriate training. It was also necessary to explain the importance of the position of electricity in the life of the nation to the outside world, about which there was abysmal ignorance. The educational work of the A.S.E.E. was expanding, a matter of the highest importance, since trained technicians were urgently needed in a ratio of at least four to one compared with the number of professional electrical engineers. The I.E.E. believed that there should be opportunities for free interchange between the two groups. To light-current engineers the electronic age offered a vast field of activity.

Mr. Flood referred to the recent Electrical Engineers' Exhibition in the promotion of which members had given their services free in token of their recognition that with success came responsibility. The speaker emphasized the importance of keeping the best type of men within the electrical industry. The toast of "Our Guests" was proposed by Mr. C. T. Melling, who addressed himself to one member—the youngest, newest and yet unknown. To him he suggested the eminence he might attain, as exemplified by the principal guests, among whom were several past-presidents of the Association as well as those distinguished in other fields. He expressed the pleasure of the members at the presence of Mr. J. M. Crowdy, the Association's first executive chairman, and of Mr. J. Eccles, deputy chairman, British Electricity Authority, who briefly responded on behalf of those present.

Interspersed with the speeches were songs by Miss Grace Nevern and character impressions by Mr. Harry Locke. We were informed by Mr. Bromfield, the A.S.E.E. secretary, that the attendance of over 600 was the largest yet recorded at this reunion.

Experimental Transmitters

THE first of six v.h.f./u.h.f. transmitters for experimental work by the B.B.C. on frequency bands III, IV and V has recently been completed at the Mullard Research Laboratories, Redhill, Surrey. This particular transmitter is designed for operation on Band III (174–216 Mc/s). The development work on the remaining five transmitters, another for operation on Band III and two each for use on Bands IV (470–585 Mc/s) and V (610–960 Mc/s), has also been completed and production of the final equipment is well under way. (The full frequency ranges of the transmitters are 174–265 Mc/s, 470–600 Mc/s, and 600–960 Mc/s respectively.)

The transmitters have been developed to a specification laid down by the B.B.C. but adaptations of the equipment could possibly be used as efficient, small-power television transmitters operating anywhere within the frequency range covered by Bands III, IV and V. It is also possible that the experience gained during the development work will be of great value when considering the design and development of unusually wide frequency range tunable transmitters for communications and other purposes.

One of the main design requirements of the new transmitters is that, for reasons of economy, they should operate at relatively low powers. This means that field strengths are extremely low compared with those normally associated with broadcast transmitters, and an unusually high order of transmitter frequency stability is necessary so that narrow-band receivers of extreme sensitivity may be used. To ensure that valid propagation measurements can be made at the receiver, it is important that the stability of amplitude should also be high.

In practice, the transmissions will normally be square-wave modulated. The signals, at a fundamental modulation frequency of 1,000 c/s, will be extracted in the receiver by means of filters. The amplitude of the signal will then be used to provide the propagation record. For investigations of multi-path transmissions and echo effects, factors of significance when operating in the higher frequency ranges, use will be made of the pulse-modulation facility also available.

A feature of the equipment is that routine measurements at different frequencies can be made by non-technical people. Furthermore, it is intended for operation in a van and to ensure complete reliability under such conditions of service the power supply unit has been designed to operate satisfactorily from single-phase, 200/250 V 45/55 c/s supplies.

A very wide band dummy load has also been designed to provide an accurate means for measuring the power output over the unusually wide frequency range covered by the transmitters. This high-precision measuring instrument consists essentially of a short coaxial line filled with carbon tetrachloride, the inner conductor consisting of a thin gold film on a glass rod. This presents a substantially resistive input impedance of 75 ohms at frequencies from 100 Mc/s upwards. The power absorbed by the dummy load is measured in terms of the temperature rise in the carbon tetrachloride cooling liquid between inlet and outlet of the dummy load. The maximum power handling capacity of the instrument is 600 W, and the power measurement accuracy is $\pm 1{\cdot}5$ W or ± 2 per cent, whichever is the greater.

Electric Irons

THE item selected for this latest of our surveys of domestic electrical apparatus, namely irons, is almost certainly the first electrical labour saving appliance to find its way into the home. Its performance and reliability are therefore of especial importance since on its satisfactory operation possibly depends the user's adoption of other pieces of electrical equipment.

The popularity of the electric iron has inevitably resulted in the development of a highly competitive market with appearance largely the dominating factor. Despite the obvious advantages of the automatic thermostatically controlled types, there still appears to be a surprisingly large demand for the lower-priced non-automatic models. The public does not yet seem to have been "sold" the idea that the lighter weight irons, now available as a result of the use of elements cast into the soleplate, are as efficient as the normal weight models and much less tiring to use.

Now a new feature enters into consideration with the large-scale appearance of steam irons which can also be used dry if desired. With the cheapest model selling at under £3, which is less than the price of some of the ordinary dry heat controlled units, there is indeed likely to be a promising market for this latest refinement. There still remains too a largely untouched market for travelling irons which may weigh as little as 1½ lb.

Manufacturer	A.B. Metal Products		Bank Hardware			Byleck
Name or model	Universal "Clem"	Standard "Clem"	1	2	3	"Victor"
Type	Travelling 100–250 V a.c./d.c.	Travelling 100–250 V a.c./d.c.	Travelling	Streamlined	Heat controlled	Thermostatically controlled
Weight	1½ lb	1½ lb	2¼ lb	4¾ lb	5½ lb	5 lb
Loading	80 W	80 W	400 W	450 W	750 W	750 W
Special features	Universal 100–250 V a.c./d.c.	100–120 V or 200–250 V a.c./d.c.	Detachable handle	Iron stand incorporated	Left or right handed. Stand incorporated	Tip-up, no lifting required, flex at end, sharp point for buttons
Finish	Chromium sole plate, coloured cover		Nickel or chromium	Nickel or chromium	Nickel, chromium or enamelled	Cream, eau-de-nil and blue grey
Price	£1 15 0	£1 12 6	On application			£3 2 6

Manufacturer	H. Cassirer ("Linlass")				Clifton Aircraft	C.W.S. ("Dudley")
Name or model	444P	446P	144	134	D1.1A	"Senior"
Type	Automatic a.c.	Automatic a.c./d.c.	Non-automatic a.c./d.c.	Non-automatic a.c./d.c.	Non-automatic	Automatic
Weight	4½ lb	4½ lb	4½ lb	4½ lb	5½ lb	4½ lb
Loading	750 W	750 W	450 W	450 W	550 W	800 W
Special features	Streamlined. Cool handle with left and right hand thumb-rest. Low bevel sole. Pilot light in automatic models				Streamlined design	Right and left hand thumb-rest
Finish	Chromium	Chromium	Chromium	Green enamel and chromium	Cream	Chromium
Price	£1 19 6	£2 2 6	£1 5 0	£1 4 0	£1 10 0	£2 5 0

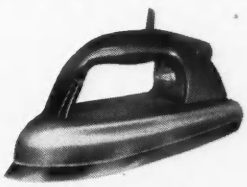
Manufacturer	C.W.S. ("Dudley")		Criterion			Elga
Name or model	"Major"	"Minor"	"Criterion"	"Criterion"	"Faraday"	A25 "Gadabout"
Type	Non-automatic	Non-automatic	Non-automatic	Non-automatic	Travelling	Travelling
Weight	5½ lb	4½ lb	3¾ lb	5½ lb	2 lb 2 oz	1½ lb
Loading	550 W	450 W	450 W	450 W	90 W	300 W
Special features	Right and left hand thumb-rest	—	—	—	Universal voltage (100–130 V and 200–250 V)	Full size. Folds flat
Finish	Chromium	Chromium	Nickel, chromium or stove enamel	Nickel, chromium or stove enamel	Nickel, chromium or stove enamel	Chromium
Price	£1 13 6	£1 2 0	£0 15 6	£1 1 0	£1 7 6	£1 18 3 in case £2 1 0 in pouch

Manufacturer	Easipower			Falk, Stadelmann		W. T. French ("Mysto")
Name or model	99	99U	100/D	"Featherlight" 95659	95669	992
Type	Automatic	Automatic universal	Automatic	Automatic, a.c. only	Non-automatic	Standard
Weight	3½ lb	3½ lb	5 lb	3 lb	4½ lb	4 lb 8 oz
Loading	600 W	600 W	600 W	750 W	450 W	450 W
Special features	Illuminated control in handle. Aluminium sole plates. Embedded element			Left or right handed. Button grooves	Left or right handed. Button grooves	—
Finish	Cream enamel	Cream enamel	Chrome and colours	Chromium or ivory	Chromium	Chromium
Price	£2 2 6	£2 2 6	£2 5 0	Chromium: £2 5 0 Ivory: £1 12 0	£1 11 6	£1 4 9

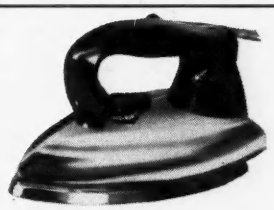
Manufacturer	W. T. French ("Mysto")	G.E.C.				Grafton
Name or model	994	"Bride's" D5850	D5850	D5805	D5827	1
Type	Thermostatically controlled	Automatic, a.c. only	Automatic, a.c. only	Non-automatic	Travelling	Non-automatic
Weight	5 lb 6 oz	2¾ lb	3¼ lb	5 lb	3 lb	2½ lb
Loading	650 W	750 W	750 W	450 W	300 W	450 W
Special features	—	Sheathed wire element embedded in light-weight sole plate. No radio or TV interference		Easy grip Bakelite handle	Universal voltage. Folding handle	Detachable handle
Finish	Cream enamel or chromium	Chromium	Cream vitreous enamel	Chromium	Chromium	Nickel or chromium
Price	£2 7 6	£2 2 6	£2 5 0	£1 12 6	£2 15 0	Nickel: £0 12 6 Chromium: £0 13 6

Manufacturer	Grafton		H.M.V.			L. G. Hawkins
Name or model	2	9	IC5	IC6	IT1	—
Type	Non-automatic	Automatic, a.c. or a.c./d.c.	Automatic	Automatic	Travelling	Automatic, a.c. only
Weight	5 lb	4 lb	5½ lb	6½ lb	3¾ lb	4½ lb
Loading	450 W	As required	750 W	750 W	450 W	800 W
Special features	—	Left and right handed. Pilot light	Bakelite handle.	Fits either hand	Folding handle. Unbreakable body	—
Finish	Nickel or chromium	Coloured or chromium	Primrose vitreous enamel	Primrose vitreous enamel	Primrose vitreous enamel	Chromium and black handle
Price	£0 15 11	Coloured: £1 15 0 Chromium: £1 19 6	A.c.: £2 5 0 A.c./d.c.: £2 10 0	A.c.: £2 10 0 A.c./d.c.: £2 15 0	£3 12 6	£2 9 6

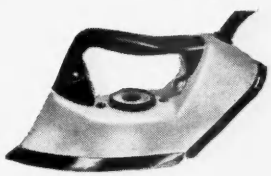
A.B. Metal Products "Clem" travelling



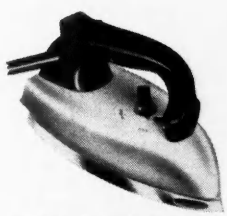
Easipower



C.W.S.



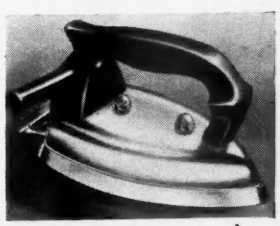
Bylock



Falk, Stadelmann "Featherlight"

Elga "Gadabout"

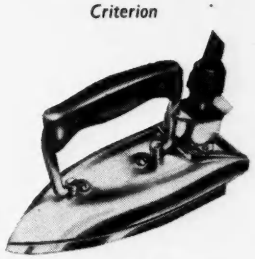
Criterion



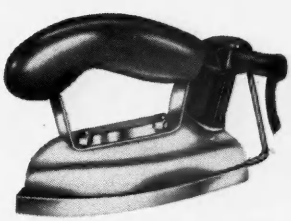
W. T. French 992

Grafton No. 9 and (below) Cassirer automatic

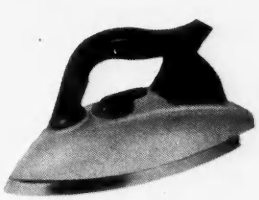
H.M.V. "IC6" and (below) travelling



G.E.C. universal voltage travelling and (below) "Bride's"



Bank Hardware travelling and (below) heat controlled

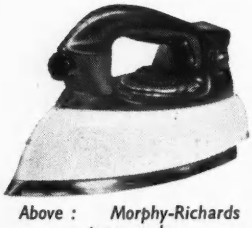


Manufacturer	Homefyre				Hoover	Hotpoint
Name or model	160	154 & 155	153	1,000	Steam or Dry	" Plus Five "
Type	Automatic or non-automatic, a.c. or a.c./d.c.	Non-automatic	Non-automatic	Light-weight non-automatic	Steam or dry	Automatic
Weight	4½ lb	154: 4 lb 155: 5 lb	4 or 5 lb	3 lb	3½ lb (empty)	5½ lb
Loading	450 W	450 W	450 W	450 W	1,000 W	800 W
Special features	Extra large smoothing surface. Pilot light if required	With or without detachable connector	Low price	No connector. Suitable for travelling	Double thumb-rest	Swivel flex. Double thumb-rest. Button nooks
Finish	Chromium, nickel or enamel	Chromium, nickel or enamel	Chromium, nickel or enamel	Chromium, nickel or enamel	Chromium with moulded handle	Chromium
Price	On application				£4 19 6	£3 15 0

Manufacturer	Hotpoint	Jelson	Archibald Kenrick	Kenwood	Lucas	Metway
Name or model	" Rightweight "	MX20	" Kensun "	" Steam-o-matic "	" Smoothie "	DA186
Type	Automatic	Automatic	Non-automatic	Steam or dry	Travelling	Travelling
Weight	3¾ lb	4½ lb	5 lb	3 lb	1½ lb	2 lb
Loading	800 W	800 W	450 W	1,000 W	100 W	150 W
Special features	As for " Plus Five "	—	—	Fill straight from tap. Stainless steel tank	Universal voltage	Nickel sole plate
Finish	Aluminium	Chromium	Enamelled or nickel	Chromium	Chromium	Nickel or colours
Price	£3 5 0	£2 5 0	£1 0 0	£4 12 6 approx.	£1 12 6	£0 18 6

Manufacturer	Metway		Morphy-Richards			
Name or model	DA446	DA226	CA75	CU75	PA75	PU75
Type	Automatic	Standard	Automatic, a.c.	Automatic, a.c./d.c.	Automatic, a.c.	Automatic, a.c./d.c.
Weight	4½ lb	5 lb	4½ lb	4½ lb	4½ lb	4½ lb
Loading	700 W	450 W	750 W	750 W	750 W	750 W
Special features	Pilot light. Chromium sole plate	Nickel sole plate	Pilot light	Pilot light	Pilot light	Pilot light
Finish	Chromium, cream, blue or green	Chromium, nickel, cream, blue or green	Coloured metal or chromium		Coloured porcelain	
Price	Chromium: £2 4 6 Colours: £2 3 9	Nickel: £1 2 9 Colours: £1 2 4 Chromium: £1 5 0	Coloured: £1 19 6 Chromium: £2 5 0	Coloured: £2 4 6 Chromium: £2 10 0	£2 5 0	£2 10 0

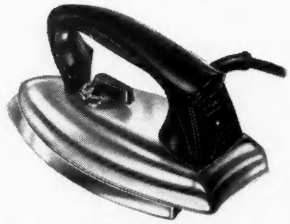
Manufacturer	Morphy-Richards					Premier
Name or model	" Atlantic " LA75	"Atlantic " LU75	GW1	GU1	ZA75	" Sylph " 861
Type	Automatic, a.c.	Automatic, a.c./d.c.	Automatic travelling, 100–250 V a.c./d.c.	Automatic travelling, 100–140 V or 200–250 V a.c./d.c.	Heat controlled, steam or dry, a.c.	Automatic
Weight	2¾ lb	2¾ lb	1¾ lb	1¾ lb	3 lb (empty)	3¼ lb
Loading	750 W	750 W	375 W	375 W	750 W	1,000 W
Special features	Pilot light. Left or right hand flex entry		Full size with folding handle. Automatic voltage selector		Boiler type. Pilot light. Reversible flex entry. Left or right hand thumb-rest	Front light. Cast-in element
Finish	Vitreous enamel or chromium		Chromium	Chromium	Chromium	Chromium
Price	£2 5 0	£2 10 0	£2 15 0	£2 5 0	£2 19 6	£2 19 6



Above : Morphy-Richards steam or dry

Below: Homefyre streamlined iron

Archibald Kenrick " Kensun " and (below) Hoover Steam or Dry

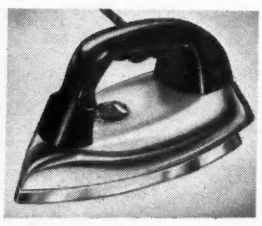


Above: Jelson heat controlled iron

Below: Hotpoint " Rightweight "

Above: Metway travelling

Below: Hotpoint " Plus Five "

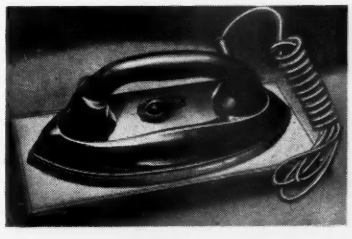


Manufacturer	Premier		T. Price (" Prilect ")			
Name or model	909	" Smoothwell " 814	2090	1672B	" Nu-Lux " 2085	2103
Type	Automatic de luxe	Non-automatic	Standard	Standard de luxe	Heat controlled	Heat controlled
Weight	5 lb	4¾ lb	5 lb	5 lb	5 lb	5 lb
Loading	1,000 W	450 W	450 W	450 W	500 W	600 W
Special features	Front light. Suitable for left or right hand	Streamlined	—	Special left or right hand grip	Metal box	Metal box. Pilot light
Finish	Chromium	Chromium	(1) Nickel (2) Chromium	Chromium	Chromium or enamel	Chromium or enamel
Price	£4 2 6	£1 8 6	(1) £0 16 9 (2) £0 17 9	£0 19 0	£1 6 6	£1 19 6

Manufacturer	T. Price (" Prilect ")			Robson		
Name or model	2027A	2027B	2086	" Explorer "	" Ultralite "	" Roblec "
Type	Travelling	Travelling	Travelling	Non-automatic	Non-automatic	Heat controlled, a.c.
Weight	2 lb	2 lb	1½ lb	5 lb	5 lb or 7 lb	4½ lb
Loading	150 W	150 W	300 W	450 W	450 W	650 W
Special features	Metal box. Detachable handle	Metal box. Detachable Bakelite handle	Full size sole plate. Folding handle	—	—	A.c./d.c.: 2s 6d extra
Finish	Nickel	Chromium	Chromium	Cream, green or blue. Nickel sole plate	Chromium	Cream, green or blue. Nickel sole plate
Price	£0 11 6	£0 15 6	£0 17 6	£0 19 6	5 lb: £1 3 0 7 lb: £1 9 3	£1 13 9

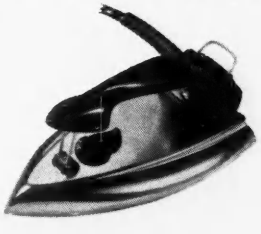
Manufacturer	Robson				Scottish Precision Engineering (" Rob Roy ")	
Name or model	" Roblec "	" Roblec "	" Roblec "	" Roblec Junior "	" Majestic " RRM25	" Majestic " RRM26
Type	Heat controlled, a.c.	Heat controlled, a.c.	Heat controlled, a.c.	Travelling	Non-automatic	Non-automatic
Weight	4½ lb	4½ lb	4½ lb	2 lb	5 lb	5 lb
Loading	650 W	650 W	650 W	150 W	450 W	450 W
Special features	A.c./d.c.: 2s 9d extra	Pilot light. A.c./d.c.: 3s extra	Pilot light. A.c./d.c.: 3s extra	—	Thumb-rest for right or left hand	
Finish	All nickel	Cream, green or blue. Chromium sole plate	All chromium	Cream, green or blue or all nickel	Enamel	Chromium
Price	£1 14 9	£1 17 6	£1 19 6	£0 15 6	£1 4 0	£1 6 6

Manufacturer	Telsen		
Name or model	1148	" Victory " 1141 & 1146	" Jubilee " 1142
Type	Travelling, 100–250 V a.c./d.c	Standard	Standard
Weight	2 lb	5 lb 10 oz	5½ lb
Loading	175 W	450 W	450 W
Special features	Streamlined with moulded handle	1146 has heel rest incorporated in moulded handle	—
Finish	Anodised	Nickel or vitreous enamel	Nickel
Price	£0 14 6	1141: £1 6 0 1146: £1 7 6	£1 0 0

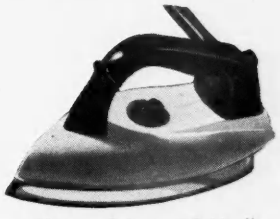


Telsen 1145 double ended model

Metway automatic

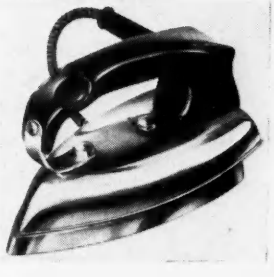


Morphy-Richards travelling



Above: Robson " Roblec "
Below: Robson Explorer

Left: Premier 909
Right: Premier " Smoothwell "



IRONS . . . . *continued*

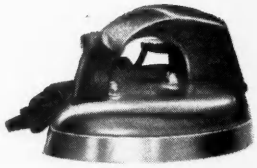
Manufacturer	Telsen				Tym's Electric ("Systym")	
Name or model	"Royal" 1144	1145	"Victory" 1149 & 1150	1147	"Golden Arrow"	"Silver Arrow"
Type	Heat controlled	Heat controlled	Heat controlled	Travelling, 100–250 V a.c./d.c.	Automatic	Automatic
Weight	5¾ lb	5½ lb	6 lb	2 lb	5 lb	5 lb
Loading	600 W	600 W	600 W	175 W	750 W	750 W
Special features	—	Double ended	Moulded heel rest. 1150 has pilot light	Wooden handle	Pilot light	Pilot light
Finish	Nickel or enamel	Nickel or enamel	Nickel	Anodised	Coloured	Chromium
Price	£2 2 6	£2 5 0	1149: £1 15 0 1150: £2 5 0	£0 12 0	A.c.: £1 19 6 A.c./d.c.: £2 4 0	A.c.: £2 1 6 A.c./d.c: £2 6 0

Manufacturer	Tym's Electric ("Systym")	J. & H. Walter
Name or model	Streamlined Safety	—
Type	Non-automatic	Thermostatic. A.c. Sold with table
Weight	4 lb	5 lb
Loading	450 W	900 W
Special features	—	No cord. Models available for d.c. and 100–110 V a.c.
Finish	Coloured or chromium	Chromium
Price	£0 18 11	£12 12 0

List of Manufacturers

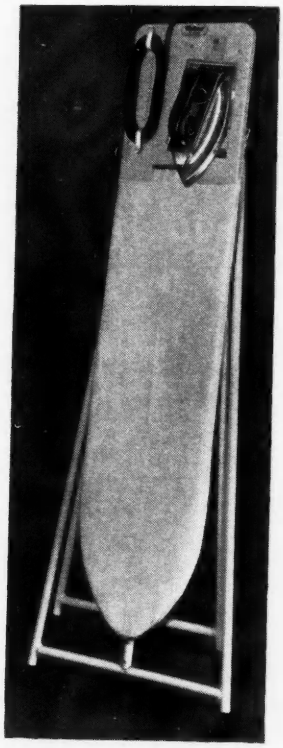
A.B. Metal Products, Ltd., Ynysboeth, Abercynon, Glam.
Bank Hardware Manufacturing Co., Ltd., Pleck Road, Walsall.
Bylock Electric, Ltd., South Street, Enfield.
Cassirer, H., Ltd., White Hart Yard, Guildford Street, Chertsey.
Clifton Aircraft, Ltd., Lytham, Lancs.
Co-operative Wholesale Society, Hall Street, Dudley.
Criterion Electric, Ltd., Abbey Estate, Mount Pleasant, Alperton.
Easipower, Ltd., 213–215, Gloucester Place, London, N.W.1.
Elga Products, Ltd., Railway Place, Wimbledon, S.W.19.
Falk, Stadelmann & Co., Ltd., 91, Farringdon Road, London, E.C.1.
French, W. T., & Son, Ltd., Browning Street, Birmingham, 16.
General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.
Grafton Heater Co., Ltd., 13–15, Westland Place, London, N.1.
H.M.V. Household Appliances, Hayes, Middx.
Hawkins, L. G., & Co., Ltd., 30–35, Drury Lane, London, W.C.2.
Homefyre, Ltd., 66–72, Brewery Road, London, N.7.
Hoover, Ltd., Perivale, Greenford, Middx.
Hotpoint Electric Appliance Co., Ltd., Peterborough.
Jelson Electric, Ltd., Spring Road, Tyseley, Birmingham, 11.
Kenrick, Archibald, & Sons, Ltd., Newman Street, London, W.1.
Kenwood Electrics, Ltd., 26, North Audley Street, London, W.1.
Lucas Holder, Ltd., 60, Rugby Road, Binley, near Coventry.
Metway Electrical Industry, Ltd., King Street, Brighton.
Morphy-Richards, Ltd., 6, Conduit Street, London, W.1.
Premier Electric Heaters, Ltd., Keeley Street, Birmingham, 9.
Price, T., & Sons, Ltd., Springhill Passage, Birmingham, 18.
Robson Electrical Products, Ltd., Union Street, West Bromwich.
Telsen Electric Co., Ltd., Fitzgeorge Street, Collyhurst, Manchester, 9.
Tym's Electric, Systym Works, Kennard Road, Stratford, E.15.
Walter, J. & H., Ltd., Farm Lane, Fulham, London, S.W.6.

Kenwood "Steam-o-matic"



Telsen 1148 streamlined travelling type

Scottish Precision Engineering "Rob Roy Majestic"



J. & H. Walter "No-Cord"

MECHANISM OF THE ELECTRIC SPARK

IN a paper delivered before the London Students' Section of the Institution of Electrical Engineers on 29th March, Dr. C. G. Morgan showed that a unified theory governed the mechanism in the three aspects of the transition of a gas from almost perfect insulator to almost perfect conductor owing to the application of an electric field. The three aspects were sparks at low pressures (about 10^{-2} atmospheres), sparks at atmospheric pressure and breakdown under very strong electric fields (10^4 to 10^5 V/cm) in highly compressed gases.

The unified theory postulated essentially the continuous development of a primary electron avalanche from behind by one or more secondary ionization processes which were effective when moving towards the cathode and most effective when acting at the cathode. Knowledge of the coefficients describing these primary and secondary ionization processes permitted accurate prediction of sparking voltage.

At low pressures the rate of development of breakdown was largely controlled by the nature and geometry of the cathode (e.g., by removal of oxide and tarnish layers on its surface), which caused changes in the sparking voltage. Measurements at Swansea showed breakdowns at atmospheric pressure to be caused by the same ionization processes and not, as was once believed, by the sudden appearance of some new mechanism dependent upon the formation of space charges. In compressed gases increased electron extraction from the cathode took place in electric fields, the strength of which alone, and not the ratio of field strength to gas pressure, determined the emission.

Extension of H.P. Terms

THE East Midlands Electricity Board is to extend the hire purchase facilities for appliances outside the scope of the Hire-Purchase and Credit Sale Agreements (Control) Orders to a maximum period of ten years. Cookers, immersion heaters, wash boilers and storage water heaters will therefore become available on this long-term hire purchase scheme and the low quarterly rentals will bring the latest models of these electrical appliances within the reach of those with the most modest incomes.

Under the new h.p. terms it will be possible to buy an up-to-date electric cooker, complete with radiant simmering plate and heat controlled oven, for as little as 3d a day, payments being made quarterly. An immersion heater installed in an existing hot water cylinder, with wiring, plumbing and lagging jacket, will cost about 10s 6d a quarter, or just under 1½d a day.

New N.W., Merseyside Division

Administration of the new North West, Merseyside and North Wales Division of the B.E.A. (formed by the merging of the North Western and Merseyside Divisions) will be in the hands of a management committee, consisting of the controller (Mr. A. R. Cooper), the deputy controller (Mr. P. Briggs) and two or more part-time members, with headquarters in Manchester. So far two part-time members have been appointed: Mr. F. Lawton, who until recently was controller of the Midlands Division, and Mr. W. S. Burge, controller of the East Midlands Division from 1948 to 1951.

Breadalbane Contracts

As briefly reported in last week's issue, the North of Scotland Hydro-Electric Board has placed contracts for the St. Fillans section of the Breadalbane hydro-electric scheme in Perthshire. The Mitchell Construction Co., Ltd., is to build the power stations at St. Fillans and at Dalchonzie, near Comrie, constructing aqueducts and driving over ten miles of large water tunnels. The St. Fillans generating station will be built underground. It will have one set with a capacity of 22,000 kW, the alternator being built by the Harland Engineering Co., Ltd., and the generator by Bruce Peebles & Co., Ltd. The estimated average annual output is 76 million kWh. The Dalchonzie station, on the bank of the River Earn, will have a 4,000 kW set, the estimated average annual output being about 18 million kWh.

The longest tunnel, carrying water from the reservoir in Glen Lednock to the St. Fillans station, will be over 18,000ft in length and will have a diameter of 9ft 6in. Another tunnel, 17,200ft long and 10ft in diameter, will bring water from Glen Almond to the reservoir in Glen Lednock. The third main tunnel, 16,200ft long and 11ft 6in in diameter, will lead water from the outlet of Loch Earn to the power station at Dalchonzie.

Taylor Woodrow Construction, Ltd., has been awarded the contract for the construction of the Lednock dam which will create a new loch near the head of Glen Lednock. This buttress type dam will be about 930ft long and 100ft high.

Supply to Flats

Westminster Housing Committee has accepted terms submitted by the London Electricity Board for laying services to blocks comprising in all 284 dwellings at Churchill Gardens, installing rising mains (but not submains) with distribution boards on each floor. The offer is conditional upon the Council's providing points in each dwelling for electric cooking and refrigeration.

Accelerated Rural Development

Speaking at a meeting of the East Midlands Electricity Consultative Council held in Nottingham last week, Mr. C. R. King, chairman of the Board, said that at 31st March last year there were more farms taking a supply of electricity in the East Midlands than in any other Electricity Board's area in the country. The number of farms connected to the Board's system at that date was 16,666, representing 62 per cent of the total number in the area. During the past nine months the Board had greatly accelerated the rate of work in the rural districts and it was estimated that during 1953–54 a further 1,400 farms would be connected, compared with 1,080 in 1952–53. This was the beginning of the Board's long-term programme of rural development covering the period up to 1958. The cost to the Board of carrying out this five-year plan, which was designed to make supplies available to a further 6,550 farms, would be approximately £4,700,000 and its successful completion would depend upon the continuation of the present policy of the Government in permitting capital to be employed to this extent.

Eastern Area Progress

In the first five years of its operations the Eastern Electricity Board provided new supplies to 60,000 rural premises, including more than 5,600 farms. This was in spite of the restrictions which had been placed on construction work by reason of the national financial position. The second five-year programme, ending 31st March, 1958, provides for new supplies being brought to more than 50,000 additional rural premises, including about 6,000 farms.

Under an arrangement which has been in operation since 1949 the Board provides supply to villages and hamlets with six premises or more without any capital contribution, revenue guarantee or line rental. Isolated premises and groups of five premises or fewer are supplied on the standard tariffs applying throughout the Board's area, but in some cases there is in addition a line rental for a limited period of seven years. As a further means of improving rural electrification the Board has now reduced the line rental terms by spreading more of this cost over consumers as a whole and is embarking on zonal schemes of development in addition to the extensions to individual hamlets and farms.

OVERSEAS

Preference for Kariba Scheme

The Salisbury, Southern Rhodesia, correspondent of the *Financial Times* reports that the Chamber of Mines has issued a memorandum criticizing the Federal Government's decision to proceed with the Kafue River hydro-electric scheme before the Kariba project. It contends that the evidence is overwhelmingly in favour of going ahead with the latter scheme at the earliest possible date and calls for the appointment of a commission to re-examine the power position of the Federation as a whole. The memorandum states that in seven years' time a greater amount of power would be available from the Kariba development than from that at Kafue, at the same cost (0·25d/kWh), and in ten years it would be possible to develop 1,000 MW and supply power at 0·18d/kWh for a capital cost of £85 million.

Brunei Electrification

A scheme to extend electricity supplies throughout Brunei, N.W. Borneo, at a cost of $20 million (£2,333,000 sterling) is being considered by the Government. The plan, submitted by a British firm of consultants, is to build a power station on the Belait River which would utilize waste from the Seria oilfield. A network of power lines would radiate through this small British-protected State to every town and kampong (communal settlement) with more than 200 people. The power plant would be built in sections and expanded as the needs of the State grew.—*Reuter.*

Financial Section

STOCKS and SHARES

IN the Stock Exchange markets the industrial sections gave a remarkable display of confidence, in the course of which the indices to share prices reached heights never before recorded. One contributory factor was the release of money tied up temporarily in the overwhelmingly successful issue of £30 million I.C.I. loan stock. This commanded in early dealings a premium of around 2½ points on the offer price of 100. Later, the premium dipped to 2 19/16 before rallying to 2⅝ premium. The electrical equipment market derived encouragement from the final dividend and preliminary profits statements of the Reyrolle and Lancashire Dynamo companies.

Reyrolle Results

Reyrolles £1 shares stood at 55s immediately after the announcement of the final dividend a year ago. Following last week's declaration for 1953, they advanced to 75s. In the interval, moreover, shareholders have been offered a valuable "rights" issue of shares at 40s. That offer raised by half the amount of capital ranking for the final dividend of 7½ per cent now declared, and for a special 2½ per cent tax-free payment. The dividend total for the year of 13¾ per cent compares with the previous rate of 12½ per cent on the smaller capital. Another increase in the year's trading surplus, to over £1·1 million, appears from the preliminary figures to involve no departure from the company's strictly conservative dividend policy. To that factor would be largely attributable the unusually low yield of under 4 per cent on the shares. C. A. Parsons shares, on which a final dividend declaration is expected in about a week's time, were marked up in sympathy.

Atomic Power

At two of last week's company meetings references were made to the future use of atomic energy in generating electric power, a development which, according to the Minister of Works, is going to lead to large-scale expenditure over the next decade or so. The market is beginning to take active notice. Mr. Mather's disclosure, at the Mather & Platt meeting, that the company has obtained important contracts for heavy plant in that connection helped to induce a rise of 5s 6d in the price of the £1 shares to 61s. At the A.E.I. meeting, Sir George Bailey spoke of the group's readiness to take an active part in the solution of problems arising from these developments.

A.E.I. Meeting

Impressions made by the general review of the A.E.I. group's position by the chairman assisted in keeping the shares well to the fore during the pre-Budget activity in the industrial market. Attention was paid in particular to the volume of orders on hand. Although lower than the figure of a year ago,

Week's Price Changes

Company or Board	Nom. Value	Middle price 5th Apr.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1953 Highest	1953 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	90		3	3	3 6 9	90	83 11/16
Brit. Elec. 1974/77	100	90	+½	3	3	3 6 8	89	82
Brit. Elec. 1976/79	100	97	+1	3⅛	3⅛	3 12 2	94⅜	88⅝
Brit. Elec. 1974/79	100	105	+½	4¼	4¼	4 1 0	104	99⅛
Overseas Electric Supply								
Calcutta Elec.	£1	20/-	+6d	6†	6†	6 0 0†	21/-	18/-
East African Power	£1	22/6	+9d	7	7	6 4 6	25/-	20/9
Nigerian Elec.	£1	23/6		10	10	8 10 3	25/-	21/6
Palestine Elec. "A"	£1	18/6	+6d	Nil	Nil	Nil	19/3	7/7
Perak Hydro-Elec.	£1	14/9	−3d	Nil	6	8 2 8	17/10	13/6
Equipment and Manufacturing								
Aberdare Cables	5/-	8/3		20	20	7 7 0*	8/9	7/4
Aerialite	1/-	11/3	−3d	88⅓	88⅓	7 17 0	11/6	8/1
Allen, W. H.	£1	57/-	+1/3	15	15	5 5 3	51/-	42/10
Aron Elec. Ord.	£1	45/-		15	20	8 17 9	47/6	36/3
Assoc. Elec. Ord.	£1	45/6	+1/-	20	11¼*	4 19 0	45/7	36/4
Automatic Tel. & El.	£1	66/3	+1/9	15	15	4 10 6	65/3	55/-
Babcock & Wilcox	£1	51/3	+2/3	18	18	—	50/-	40/4
Baldwin, H. J.	2/-	4/6		20	20	8 18 0	4/1	3/-
Bakelite	10/-	25/-		12½	12½	5 0 0	24/9	16/-
British Aluminium	£1	36/3	−2/9	12	10	5 10 3	43/10	35/-
B.I. Callender's	£1	42/6	+3/-	9	10	4 14 3	40/10	33/3
B.I. Callender's 6% Pref.	£1	26/-		6	6	4 12 3	26/3	23/-
British Thermostat	5/-	20/-		30	35	—	19/-	14/-
British Vac. Cleaner	5/-	13/3		25	25	9 8 9	16/6	11/-
Brook Motors	10/	36/6	+1/-	20	20*	5 9 6	37/-	27/10
Brush Ord.	5/-	6/9	+9d	4	6	4 9 0	5/4	2/11
Bulgin, A. F.	1/-	3/3	−1½d	30	30	9 4 6	3/4	2/6
Burco	5/-	13/6	+9d	35	35	6 9 9*	12/2	8/6
Chloride El. Storage	£1	56/3	+3/9	15	20	3 11 0*	44/10	32/3
Clarke Chapman	£1	75/9		17½	20	5 5 6	70/6	57/6
Cole, E. K.	5/-	23/6xd		25	25*	5 6 6	23/9	14/2
Cossor, A. C.	5/-	8/-	+6d	10	10	6 5 0	11/4	6/4
Crabtree	10/-	25/9		17½	17½	6 16 0	32/6	23/9
Crompton Parkinson Ord.	5/-	16/-		11¼	20	6 5 0	16/-	8/7
De La Rue	5/-	13/9	+3d	35	Nil	Nil	14/6	6/3
Decca	4/-	36/9	+2/3	150	35*	—	37/9	17/6
Desoutter	5/-	18/3		18	20	5 9 6	17/6	14/3
Dewhurst	2/-	5/6		19	19	6 18 3	6/9	5/-
Dictograph Tel.	2/-	5/9		20	20*	6 19 3	5/10	3/10
Dubilier Condenser	1/-	5/-		28	25*	5 0 0	4/4	2/10
E.M.I.	10/-	13/6		12	8	5 18 6	15/3	11/6
Electrical Components	5/-	11/3		20	20	8 17 10	12/-	9/3
Elec. Construction	£1	56/3		15	15	5 6 8	56/-	50/6
Enfield Cable Ord.	£1	18/9	+1/3	7½	5	5 6 9	24/10	17/-
English Electric	£1	40/-		15	10*	5 0 0	40/8	34/-
English Electric 3½% Pref.	£1	15/6		3½	3½	4 15 3	16/4	14/6
Ericsson Tel.	5/-	46/6	+3d	22†	25†	2 13 9†	48/9	36/-
Ever Ready	5/-	29/-	+2/6	35	35	6 0 8	29/-	25/-
Falk Stadelmann	£1	40/-		15	15	7 10 0	44/3	38/3
G.E.C. Ord.	£1	40/9	+1/3	22½	11½*	5 10 6	46/-	36/3
G.E.C. 6½% Pref.	£1	27/-		6½	6½	4 16 3	27/7	24/9
General Cables	5/-	16/9		30	30	8 19 2	17/-	14/9
Greenwood & Batley	£1	43/9		15	17½	8 0 0	41/6	38/-
Hackbridge Cable	5/-	13/6		20	20	7 8 3	13/-	10/4
Hackbridge & Hewittic	5/-	18/9	+3d	20	20	5 6 9	18/3	16/1
Hall Tel. Acc.	10/-	11/6		10	10	8 13 10	12/7	8/6
Heatrae	2/-	4/-		12½	12½	6 5 0	4/3	3/3
Henley's	10/-	16/6	+6d	20	10½*	6 7 3	19/4	16/-
Holophane	5/-	14/9		20	20	6 15 7	13/9	11/1

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List

they still amount to the "comfortable total" of £124 million. Sir George welcomed the ending of the excess profits levy, which again cost the group well over a million last year. The increase in the ordinary distribution to 11¼ per cent looks very moderate in the light of the "break-down" figures given to show the allocation of the year's payments. Out of every 20s paid out, all dividends took only 6d, against 9s 3d for wages, 8s 5d for materials, etc., and 1s 10d for taxation. Since 1938 total dividend distributions have risen by less than a quarter, while the amount of wages and salaries has been more than quadrupled.

in Electrical Investments

Company or Board	Nom. Value	Middle price 5th Apr.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1953 Highest	1953 Lowest
Equipment and Manufacturing—continued.						£ s d		
Hoover	5/-	34/3	+1/6	25	45	6 11 6	26/10	20/3
I.C.I.	£1	58/3	+1/9	13	15	5 3 0	54/-	41/6
Intl. Combustion	5/-	19/6		15	20	5 2 6	15/6	12/1
Johnson & Phillips	£1	52/-	+1/-	15	15	5 15 6	59/3	49/-
Lancashire Dynamo	£1	47/6	+1/3	12½	14	5 18 0	47/-	41/-
Laurence, Scott	5/-	16/9		15	15	4 9 6	14/6	11/9
Lister, R. A.	£1	35/9		9	12	6 14 3	34/3	27/9
London Elec. Wire	£1	41/6	+3/-	12½	15	3 12 0*	38/3	26/-
Lucas, J.	£1	63/9xd	+1/6	9⅛	10⅝	3 8 0	51/3	35/6
Marryat & Scott	2/-	6/6		22½	22½	6 18 6	6/3	5/1
Mather & Platt	£1	61/-	+5/6	12½	15	4 18 2	53/10	41/3
Metal Industries	£1	30/3		15	12*	7 18 6	47/9	37/9
Midland Elec. Mfg.	£1	63/3		15	15	4 14 9	63/9	56/3
Morphy-Richards	4/-	14/6		40	40	—	16/3	13/-
Murex	£1	54/-	+3/-	15	15	5 11 0	60/9	50/6
Newman Ind.	2/-	2/3xd		10	10	8 17 9	2/10	2/-
Oldham & Son	1/-	2/9		35	17½*	6 7 3	2/10	2/2
Parnall (Yate)	5/-	6/3		6	6	4 16 0	4/9	2/6
Parsons, C. A.	£1	43/9	+2/6	10*	12½	—	48/-	27/9
Plessey	5/-	51/3	+4/-	25	30	2 18 6	37/-	20/1
Pye Deferred	5/-	23/6	+3/6	18	20	—	16/3	10/6
Revo	10/-	17/6		27½	27½	—	17/6	13/11
Reyrolle	£1	75/-	+3/9	12½	13¾	3 14 6	79/-	51/-
Rheostatic	4/-	12/-		19	20	6 13 4	12/-	8/-
Richardsons Westgarth	5/-	12/3	+1/3	12	15	6 2 6	11/1	8/6
Scottish Cable	4/-	14/6	+3d	32	20*	5 10 3	13/3	11/1
Siemens Ord.	£1	37/6		10	10	5 6 8	37/-	31/6
Smith (England), S.	4/-	9/9	+9d	12½	15	—	12/6	7/11
Southern Areas	£1	18/-		5	6	6 13 4	19/7	10/3
Strand Elec.	5/-	8/3	−6d	17½	17½	10 12 3	10/-	7/9
Sturtevant	5/-	33/9		17½††	18·1††*	—	29/9	20/10
Sun Elec.	£1	27/6		15	15	10 18 3	27/-	24/6
Switchgear & Cowans	5/-	10/-xd		22½	10	5 0 0	16/9	12/6
Taylor Tunnicliff	5/-	11/-	−3d	25	12½*	5 13 9	12/3	9/6
T.C.C.	10/-	45/-		20	20*	—	42/6	31/5
T.C. & M.	£1	32/6	+1/9	10	8½*	5 4 6	31/6	25/6
Telephone Mfg.	5/-	8/6		10	10	5 17 8	9/4	7/1
Thorn Elec.	5/-	17/3	+3d	12½	12½	3 12 6	14/-	7/10
Thornycroft	£1	35/-		15	15	8 11 6	54/-	29/9
Tube Investments	£1	65/-	+3/9	15*	15	4 12 4	71/9	54/-
Vactric	5/-	9/6		Nil	Nil	Nil	10/3	3/6
Veritys	5/-	6/6		7½	10	7 13 9	5/4	4/1
Walsall Conduits	4/-	50/-	+3/-	70	70*	5 12 0	47/6	43/9
Ward & Goldstone	5/-	45/-		45	45*	5 0 0	46/-	29/9
Watford	2/-	6/3		25	25	—	5/6	4/10
Westinghouse Brake	£1	67/6		14	15	4 9 0	64/-	51/3
West, Allen	5/-	14/6	−3d	15	17½	6 0 9	14/4	10/3
Wolf Electric	5/-	13/-		15	17½	6 14 6	12/8	9/6
Trusts, Transport and Communications								
Anglo-Am. Tel.:								
A Ord.	100	86	−1½	—	6	6 19 6	91	77
Ord.	100	55½		—	3¾	6 15 3	57½	53
Anglo-Portuguese	£1	22/-	+1/-	8	8	7 5 6	23/9	20/1
Brit. Elec. Traction:								
Def. Ord.	5/-	42/6		25	35	4 2 3	39/6	21/3
Cable & Wireless:								
Ord.	£1	37/-	+3/-	8	9	4 17 3	148	124
4% Loan	100	96½		4	4	4 3 0	97¾	93
Calcutta Trams	£1	18/-		6†	2½††	—	23/6	16/-
Cape Elec. Trams	£1	14/6		5½	5½	7 11 9	13/-	9/-
Marconi Marine	£1	28/3		10	10	7 1 7	31/6	26/9
Oriental Tel. Ord.	£1	79/-		16	16	—	75/-	59/-
Telephone Props.	£1	5	+5/-	8	8	—	126/3	33/-
Telephone Rentals	5/-	9/6		10	10*	—	10/-	6/8

Lancashire Dynamo Dividend

Results for 1953 published by Lancashire Dynamo came well up to the expectations on the strength of which, for some time, the shares have been consistently supported. In addition to the 12½ per cent ordinary dividend the company proposes a cash bonus of 1½ per cent. The steady expansion of recent years in the group's trading surplus has progressed further to a little over the half-million mark, so that the larger total distribution of 14 per cent remains well within the earnings available.

British Aluminium

British Aluminium's final dividend of 6 per cent and the preliminary profits statement, reflected a setback larger than the market had been expecting, although advance warning was given by the company at the time of the interim dividend declaration last September. The total dividend for the year is at the same rate of 10 per cent as for some years previously, but the 2 per cent bonus paid on the last two occasions is now being omitted.

E. Shipton

Dealings began on Monday of this week in the 2s ordinary shares of E. Shipton (Holdings). They have come to the market by way of a placing of half the million shares which constitute the company's issued capital. According to the advertised particulars, the company was incorporated last month to acquire the whole of the share capital of E. Shipton & Co., Ltd., and of Industrial Appliances, Ltd. The combined profits for the twelve months just ended are estimated at not less than £45,000. Assuming similar results for the current year, the board's intention will be to declare an ordinary dividend of 17½ per cent. On that basis the indicated yield on the shares, which were quoted around 3s 9d in initial dealings, is £10 13s 4d per cent.

Telephone Properties Proposals

The board of Telephone Properties promises shareholders an early statement on the proposals whereby alternatives will be offered to those of them who do not wish to keep their investment in the company in its new form. Following the sale of the company's Venezuelan telephone interests, it may be recalled, the original intention was to use the proceeds in continuing the business as an investment company. As a result of schemes subsequently prepared, shareholders will, it is understood, now have the option of either retaining the whole of their Telephone Properties stock, or exchanging the greater part of it for shares in a new realization company.

REPORTS and DIVIDENDS

Associated Electrical Industries, Ltd.—A record rate of production during 1953 was announced by Sir George Bailey (chairman) at the annual meeting held on 31st March. He said that shipments both home and abroad totalled £86·1 million, as compared with £76 million for 1952. During the years from 1946 to 1953, the A.E.I. group of companies spent £16 million on buildings and plant, and the fruits of this expenditure were to be seen in the increased physical output, which during 1953 resulted in profits before taxation of some £10·74 million, as compared with £9·90 million in 1952.

Total orders received during the year showed a reduction as compared with the previous year, but orders in hand still amounted to £124 million with deliveries extending into 1957. The reduction in orders enabled them to offer shorter deliveries and so increase their competitive advantage.

Plant commissioned for the British Electricity Authority in 1953 aggregated more than 750 MW, and the Metropolitan-Vickers share of 550 MW constituted a record for that company. Companies in the group had also received valuable orders from the B.E.A. for switchgear, including equipment for the 275 kV super-grid switching station at Staythorpe (Metropolitan-Vickers), 275 kV isolators (Ferguson Pailin), and 120,000 kVA transformers (B.T.H. Co.). The B.T.H. Co. was supplying 132 kV switchgear for the North of Scotland Hydro-Electric Board which would be of such a design as to make it the first of its kind in the United Kingdom. That company had also received orders for compressors and exhausters, including an air compressor handling 2,000 cu ft of air per minute at 18 lb/sq in and driven by a 200 h.p. flameproof motor for the National Coal Board. A 1,225 h.p. automatic a.c. winder commissioned by the Metropolitan-Vickers Co., for the Lynemouth Colliery in Northumberland, embodied design features which would make it the first of its kind in the world.

Orders received for the steel industry included one by the B.T.H. Co. from the Steel Company of Wales for electrical equipment for a tandem cold tinplate strip mill embracing motors totalling approximately 20,000 h.p. The I.C.I. had ordered ten heavy current mechanical rectifier equipments, each rated at 15,000 A.

The Edison Swan Electric Co. had had to deal with a heavy load on the factory for cathode-ray tubes and valves for television receivers. It had maintained its position in the cable market and was increasing its activities in the field of accumulators, wiring accessories and electro-medical equipment.

Referring to exports, Sir George said that 1953 shipments exceeded those of the previous year by 14 per cent and constituted a record for the group. Important items were a B.T.H. 25,000 kW hydrogen-cooled turbo-alternator set for the Nova Scotia Light & Power Co., and the first of six 16,700 kVA waterwheel alternators at Owen Falls for the Uganda Electricity Board.

Important Metropolitan-Vickers orders were a 60,000 kW turbo-generating plant for the Catalagzi power station, Turkey, and a 66,000 kW turbo-alternator set for the Calgary Power Co. Steel works in Australia and oil refineries there and in Aden, India and South Africa, provided valuable orders for motors and control gear.

Speaking of competition from other countries, Sir George said that it was evident that Continental and Japanese firms were prepared to accept orders at extremely low prices and short deliveries. In the matter of deliveries the group could offer effective competition, but the low price level was a serious matter and demanded investigation from all angles.

Turning to research activities, the chairman said that they had evolved new techniques in the exploration of surface structures of materials, of paramount interest in the study of wear of components such as bearings and gears. New ceramic materials, glasses and resinous materials had been produced. On the lighter side of engineering, electronics provided them with ever extending possibilities. In deep therapy, Metropolitan-Vickers had presented to Christie Hospital, Manchester, a betatron which provided X-rays corresponding in penetrating power to those of a 20-million-volt X-ray tube. Steady progress was being made in the field of gas turbines and the B.T.H. Co. was dealing with orders for a number of "Cinemascope" equipments for stereophonic wide-picture projection. When colour television was provided, the Edison Swan Co. would be ready to produce the necessary cathode-ray tubes and valves for its reception.

The board was embarking upon a further long-term expansion plan for the manufacture of heavy electrical plant and steam turbines for both the M-V and B.T.H. Companies and the Edison Swan and Ferguson Pailin Companies were expanding their facilities in the television component and switchgear fields.

Clarke, Chapman & Co., Ltd.—At the annual meeting held on 31st March, Mr. J. B. Woodeson (chairman) said that the new structural shop, referred to last year, was now in full production and had relieved the heavy pressure upon their boiler and conveyor departments. They had also been able to reorganize their pulverizer manufacturing plant so as to speed up output to meet the increased demands of the British Electricity Authority.

The Brunswick Wharf station of the B.E.A. was now nearing completion, and the whole of this station was fired by their Raymond bowl pulverizing equipment. Good progress was also being made at the power stations at Bedford, Belfast and Stella, and they were busy with a number of industrial steam-raising units. Regarding overseas markets, during 1953 they had felt severely the competitive pressure from Continental countries. Their activities in India and Canada continued to develop, and steps to register a company in Canada had been taken and they were about to open an office in Montreal.

Ericsson Telephones, Ltd.—Presiding at the annual meeting held on 31st March, Sir Harold A. Wernher (chairman) mentioned that it was the fifty-first annual meeting and he briefly reviewed the growth of the company during the past fifty years. Referring to the past year's results he said that the slight recession in trading profits could be attributed to the intensified competition. In overseas markets their business was widespread and fluctuations in different parts of the world affected them in varying degrees.

With regard to the home market the interruption of Post Office plans during the war resulted in an accumulation of applications in the region of 600,000. The waiting list had been reduced to something like 300,000. Sir Harold criticized the stringent limits set by the Treasury upon telephone development and said that if sufficient funds were made available, the manufacturers were well able to supply all the plant that would be required.

Referring to the expansion of the company's range of products, the chairman mentioned work in connection with cathode-ray tubes and the like. Their sales in this field had increased satisfactorily. In collaboration with Pye, Ltd., they had developed the Ericsson/Pye V.H.F. multiplex radio-telephone system.

At an extraordinary meeting which followed, resolutions were passed for the transfer of £500,030 from reserves, the issue of one new share for every share held, and the increase of the capital of the company by £600,000, leaving £99,970 unissued.

Lancashire Dynamo Holdings, Ltd.—The group net profit for 1953, before taxation, is £505,454, as compared with £488,302 for 1952. Taxation requires £291,813, and with taxation provisions of previous years no longer required of £16,266, the balance available is £229,907 (against £200,531), of which £58,418 is retained in subsidiaries' accounts. It is proposed to pay a final ordinary dividend of 8½ per cent (unchanged), and in addition, a bonus of 1½ per cent, making a total for the year of 14 per cent (against 12½ per cent).

The Superheater Co., Ltd.—After providing £288,912 for taxation, and including interest, the profit for 1953 is £220,493, as compared with £179,189

for 1952. To this is added provision no longer required of £15,000, and a balance of £75,187 brought in, making £310,680 available. Revenue reserves receive £158,000 and expenses written off are £492. It is proposed to pay a second and final dividend on the ordinary and "A" ordinary shares of 30 per cent., making 40 per cent for the year. The total for 1952 was 35 per cent, and the interim dividend was paid on capital before the scrip issue of 16⅔ per cent. The balance carried forward is £77,619.

Reliance-Clifton Cables & Industrial Products, Ltd., proposes to make preference and ordinary scrip issues. Ordinary stockholders are to be given one 5 per cent cumulative preference and three new ordinary £1 shares for each £4 of stock held. The issues will capitalize £157,000. The directors state that the proposed ordinary issue does not imply any increase in the total amount of dividend that they may recommend for distribution. An extraordinary meeting to approve the proposals will be held on 28th April.

A. Reyrolle & Co., Ltd., report a net profit for 1953, after providing £1,888,153 for taxation, of £1,159,105, as compared with £907,506 for the preceding year. It is proposed to pay a final ordinary dividend of 7½ per cent on £3,052,941 capital; an interim dividend of 6¼ per cent was paid in September last on £2,035,294 capital. It is also proposed to make a special capital distribution of 2½ per cent, not subject to income tax, on the ordinary capital, out of a surplus realized by the sale of an investment. For 1952 the final ordinary dividend was 7½ per cent, making 12½ per cent for the year on the smaller capital.

G. & J. Weir, Ltd.—The accounts for 1953 show a consolidated net group surplus of £804,269, as compared with £570,398 for 1952. Taxation absorbed £1,546,742, and the profit attributable to the parent company is £491,375 (against £380,312). Reserve receives £257,070. It is proposed to pay a final dividend of 16 per cent (against 12 per cent), making 21 per cent for the year (17 per cent). The balance carried forward is £249,756 (against £223,566 brought in).

Allen West & Co., Ltd.—The accounts for the year ended 31st January last show, subject to audit, a group profit of £834,000, as compared with £896,330 for the previous year, and a net balance of £339,000 (against £429,475). Taxation absorbed £495,000. It is proposed to maintain the dividend for the year at 15 per cent, and in addition to pay a bonus of 2½ per cent.

Blaw Knox, Ltd., show a net profit for 1953 of £182,838, as compared with £168,509 for 1952. General reserve receives £100,000 and it is proposed to pay a final dividend of 20 per cent, maintaining the distribution for the year at 30 per cent.

It is proposed to capitalize £49,111 by paying up 196,444 ordinary 5s shares to be distributed free to holders on a basis equivalent to 22½ per cent to their shareholding. The new ordinary will not participate in dividends paid for 1953.

Murphy Radio, Ltd., in a preliminary statement, show a consolidated profit for 1953 of £353,572, as compared with £415,032 for the preceding year, but after a reduced taxation charge of £208,234 the net profit is higher at £145,338, an increase of £4,398. It is proposed to pay an ordinary dividend of 15 per cent for the year on capital of £700,000 (against 10 per cent on £500,000 capital).

Parkinson & Cowan, Ltd., report a consolidated gross trading profit for 1953 of £330,221, as compared with £355,422 for 1952. The group net profit, after all charges (including taxation of £75,875) and after crediting £64,330 in respect of taxation adjustments relating to previous years, is £144,739 (against £75,380). It is proposed to pay an ordinary dividend for the year of 9 per cent (against 7 per cent).

The British Aluminium Co., Ltd., reports a trading profit for 1953, after depreciation and transferring £100,000 to plant replacement reserve, of £882,117, as compared with £2,460,991 for 1952. Taxation requires £409,127, and the net profit is £409,699 (against £684,999), of which £388,314 is attributable to the parent company. It is proposed to pay a final ordinary dividend of 6 per cent (against 8 per cent), making 10 per cent for the year (12 per cent). The balance carried forward is £450,346 (against £431,205 brought in).

J. & F. Stone Lighting & Radio, Ltd., has declared an interim ordinary dividend of 10 per cent (same), on capital as increased by the recent bonus issue.

The British Electric Resistance Co., Ltd., has declared an interim dividend of 2½ per cent (against 5 per cent) on doubled capital.

Telephone Properties, Ltd.—The directors have announced their intention to submit proposals to stockholders whereby, *inter alia*, holders of ordinary stock may either exchange the greater part of their stock for shares of a new realization company, or retain the whole of their stock in Telephone Properties.

Joseph Lucas (Industries), Ltd.—Application is being made to the Treasury for permission to issue, by capitalizing reserves, one new share for each ordinary or redeemable preference share now held. The directors also announce an interim dividend of 6d per share on the existing ordinary and redeemable preference shares (against 4d per share). Contingent on approval being given to capitalize reserves, it is the intention of the Board to ask authority from shareholders to issue to the Lucas workers' share bank (which holds all the redeemable preference shares of the company) a further 150,000 redeemable preference shares for cash at par, such further shares to participate in the proposed scrip issue.

New Companies

Easco Electrical (Holdings), Ltd.—Registered 26th March. Capital £15,000. To acquire the business of electrical equipment manufacturers carried on by Easco Electrical, Ltd., at Brixton, S.W. Directors: E. L. Eastell (chairman) and Margery M. Eastell. Regd. office: 6/8, Brighton Terrace, Brixton, S.W.9.

R. H. Murcott, Ltd.—Registered 27th March. Capital £15,000. To acquire the business of an electrical, radio and television contractor and retailer now carried on by R. H. Murcott at Great Central Road, and Wards End, Loughborough, Leics. Directors: R. H. Murcott and Mrs. Muriel E. Murcott. Regd. office: Great Central Road, Loughborough, Leics.

Brentford Electric, Ltd.—Registered 23rd March. Capital £100. Manufacturers of and repairers of and dealers in dynamos, armatures, condensers, magnetos, batteries, etc. Regd. office: Kidbrooke Park Road, Kidbrooke, S.E.3.

P. & B. Servicing Co. (Bedford), Ltd.—Registered 25th March. Capital £100. Manufacturers and repairers of and dealers in electrical and mechanical apparatus and accessories, radio and television sets, etc. Directors: P. H. Carlow, B. Braithwaite, and A. A. Jones. Regd. office: 14a, St. Marys Street, Bedford.

Yeo's (Fleetwood), Ltd.—Registered 26th March. Capital £2,000. To acquire the business of retail electrician and electrical contractor and engineer carried on by F. W. Yeo at Fleetwood, as "Yeo's." Directors: F. W. Yeo and Mrs. Margaret Yeo. Reg. office: 186, Lord Street, Fleetwood.

Bankruptcies

S. I. Chapman, trading as S. Chapman & Co., at 103, Endsleigh Court, London, W.C.1, electrical agent.—Order made 3rd March suspending discharge for one year, and that he be discharged as from 3rd March, 1955.

W. J. Standing, 7, Brook Street, Chester, electrician.—Trustee, Mr. S. O. Henry, 5, Rumford Place, Chapel Street, Liverpool, appointed 25th March.

W. P. Wann, carrying on business at Grape Lane, York, as "Electricity Service," electrical engineer.—Trustee, Mr. W. H. Meredith, 29, East Parade, Leeds, 1, Official Receiver, released 24th March.

Count J. P. Zaluski (deceased), electronic engineer, lately of 8, Palace Gardens Mansions, Kensington, London, W.8.—Trustee, Mr. R. L. Davis, 58, Theobald's Road, London, W.C.1, appointed 26th March.

T. Sarginson, 1, Dragley Beck, Ulverston, Lancs., lately carrying on business at the Market Hall, Ulverston, electrician.—Trustee, Mr. D. Atkinson, 14, Lowther Street, Carlisle, Official Receiver, released 27th March.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 19th May from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1949

118. Elliott Bros. (London), Ltd.—Light beam stabilizing systems. 2nd January, 1950. (709331.)

27867. Telefonaktiebolaget L. M. Ericsson. —Electron tube device. 31st October, 1949. (709264.)

30742. Mullard Radio Valve Co., Ltd., and Jenkins, J. A.—Electron optical image convertor tubes. 23rd October, 1950. (709192.)

1950

3366. Postmaster General.—Ionization gauges. 17th October, 1951. (709266.)

6393. British Thomson-Houston Co., Ltd., and Cox, H. E.—Oil circuit breakers for e.h.v. electrical power circuits. 13th June, 1951. (709195.)

9144. Mullard Radio Valve Co., Ltd.—Gas-filled electric discharge tubes. 9th April, 1951. (709103.)

16817. British Insulated Callender's Cables, Ltd.—Extrusion of metal. 4th July, 1951. (709184.)

20015. Benjamin Electric, Ltd., and Studholm, J.—Holders for electric lamps. 12th October, 1951. (709105.)

22885. Synchronome Co., Ltd.—Secondary clocks. 18th September, 1951. (709334.)
22886. Clocks. 18th September, 1951. (709335.)

31111. Stromberg-Carlson Co.—Automatic telephone systems. 21st December, 1950. (709350.)

31594. British Thomson-Houston Co., Ltd. —Electric control systems for electric motors, steam engines and other prime movers. 11th October, 1951. (709336.)

31602. Altenbach, F.—Accumulator testing devices. 29th December, 1950. (709271.)

1951

1229. Siemens & Halske Akt.-Ges.—Cathodes for electric-discharge tubes. 16th January, 1951. (709274.)

3305. Ferranti, Ltd.—Aircraft navigational computers. 18th April, 1952. (709107.)

4127. General Electric Co., Ltd.—Methods for soldering armature conductors to commutator segments in dynamo-electric machines. 20th February, 1952. (709207.)

11000. Ellenberger & Poensgen Ges.—Thermal over-current electric circuit breaker. 10th May, 1951. (709114.)

13713. General Electric Co., Ltd., and Imm, R. C.—Electrical oscillation generators. 9th June, 1952. (709214.)

14135. Metropolitan-Vickers Electrical Co., Ltd.—Electrical protective systems. 30th April, 1952. (709216.)

14142. Motor-Columbus Akt.-Ges. für Elektrische Unternehmungen.—Electric cables. 14th June, 1951. (709118.)

14262. King, Ltd., G. W.—Power operated hoists. 24th April, 1952. (709217.)

15806. British Fibrak Separator Co., Ltd. —Manufacture of fibrous webs for use in making separators for storage batteries. 3rd July, 1951. (709343.)

16731. English Electric Valve Co., Ltd.—Magnetrons. 30th May, 1952. (709129.)

18151. Marconi's Wireless Telegraph Co., Ltd.—Circuit arrangements for producing electrical pulses time-modulated in accordance with modulating signals. 31st July, 1951. (709223.)

18924. Klangfilm Ges.—Magnetic heads for magnetic sound recording apparatus employing high-frequency bias. 10th August, 1951. (709287.)

21085 & 22504. Pye, Ltd.—Television transmitting apparatus. 8th and 25th September, 1952. (709289 & 709135.)

21735. Santon, Ltd.—Rotary electric switches. 16th December, 1952. (709290.)

21776. Ferranti Meters, Ltd., D., Sykes, J. H., and Knowles, A. D.—Electric switches having arcing contacts. 26th August, 1952. (709291.)

22702. Radio Corporation of America.—Colour television systems. 28th September, 1951. (709349.)

23046/7. General Electric Co., Ltd., and Booker, F.—Operating mechanisms for on-load tap-changing arrangements for electric transformers and the like. 3rd October, 1952. (709227/8.)

23171. Trautman, O. C.—Refractory core for a helical resistance element and an electrical immersion heater. 4th October, 1951. (709294.)

24455. British Thomson-Houston Co., Ltd. —Control of electric motor drives for rolling mills and the like. 19th October, 1951. (709297.)

25840. Metropolitan-Vickers Electrical Co., Ltd.—Electric waveguides for accelerating charged particles. 15th August, 1952. (709137.)

25940. Filter, W.—Electromagnetic driving devices for the shuttles of looms. 6th November, 1951. (709299.)

27375. Automatic Telephone & Electric Co., Ltd.—Electric contact springsets. 17th November, 1952. (709140.)

27396. Wilmot-Breeden, Ltd.—Electric lamp switches. 5th November, 1952. (709374.)

27397. Wilmot-Breeden, Ltd.—Electric reading lamp for use in a vehicle interior. 5th November, 1952. (709303.)

29396. Hercules Powder Co.—Electric detonators for blasting and like purposes. 14th December, 1951. (709142.)

1952

97. Compagnie Radio-Cinema.—High and constant gain amplifier. 1st January, 1952. (709235.)

647. Bosch Ges., R.—Motor-compressor units especially for refrigerators. 9th January, 1952. (709311.)

991. Ferranti, Ltd.—Apparatus for measuring the amplitude of a mechanical vibration. 12th January, 1953. (709312.)

1256. Mullard Radio Valve Co., Ltd.—Electrical lead-in arrangements. 16th January, 1952. (709236.)

1951. Electric Storage Battery Co.—Production of microporous material. 24th January, 1952. (709146.)

4482. Babcock & Wilcox, Ltd.—Tubulous vapour generating and superheating units. 20th February, 1952. (709317.)

6677. British Thomson-Houston Co., Ltd. —Colour television systems. 14th March, 1952. (709245.)

9063. Lukens Steel Co.—Electrical power systems for steel rolling mills. 9th April, 1952. (709320.)

9238. Philips Electrical Industries, Ltd.—Electric-discharge tubes. 10th April, 1952. (709380.)

9442. Automatic Electric Laboratories, Inc. —Multi-frequency generator. 15th April, 1952. (709156.)

10638. Telefunken Ges. für Drahtlose Telegraphie—Means for deflecting the ray of a cathode-ray tube. 28th April, 1952. (709382.)

10755. Steatit - Magnesia Akt. - Ges.—Cinema projectors with an electric drive. 29th April, 1952. (709385.)

13174. Electro-Mecanique de l'Aveyron.—Eddy-current brakes. 23rd May, 1952. (709162.)

14942. Westinghouse Electric International Co.—Electric circuit breakers. 13th June, 1952. (709165.)

15061. Allmanna Svenska Elektriska Aktiebolaget.—Self-excited transductors. 16th June, 1952. (709250.)

16122. Jones, T. A.—Electric plug and socket couplings. 9th April, 1953. (709389.)

16265. Electrolux, Ltd.—Absorption refrigerating apparatus. 27th June, 1952. (709166.)

16854. Babcock & Wilcox, Ltd.—Tube expanders. 4th July, 1952. (709168.)

17562. Standard Telephones & Cables, Ltd.—Radio frequency antennæ. 11th July, 1952. (709351.)

20061. Spahr, O.—Single-phase compound motors. 8th August, 1952. (709354.)

20459. Philips Electrical Industries, Ltd.—Acoustic transformation systems. 14th August, 1952. (709355.)

22391. Standard Telephones & Cables, Ltd. (Federal Telecommunication Laboratories, Inc.).—Ultra-high-frequency filter. 5th September, 1952. (709328.)

22983. Babcock & Wilcox, Ltd.—Waste heat tubulous vapour generators. 12th September, 1952. (709329.)

23630. Officine Elettromecc. F. Rapizzi & F. Di Gaetano Rapizzi.—Electric switches having manual and automatic operation. 19th September, 1952. (709173.)

25183 & 28038. Bosch Ges., R.—Electric storage batteries. 8th October and 7th November, 1952. (709254/5.)

25353. Moser-Glaser & Co. Akt.-Ges.—High-voltage electric transformers. 9th October, 1952. (709361.)

29344. General Electric Co.—Methods of stabilizing semi-conductor materials. 20th November, 1952. (709364.)

29948. Philips Electrical Industries, Ltd.—Cathode bodies. 26th November, 1952. (709367.)

30214. General Electric Co.—Defrost actuators for refrigerators. 28th November, 1952. (709368.)

30431. Hazeltine Corporation.—Colour-television signal-translating system. 1st December, 1952. (709257.)

E.B.R.A. Guide

The second edition of the " Engineer Buyers' and Representatives' Association Guide and List of Members " has just been issued by the Association, 47, Victoria Street, Westminster, London, S.W.1. It contains the names and their firms of some 300 new members who have been enrolled since the last edition was published. The new guide supplements rather than supersedes the first edition, and a number of features and sections, although still valid, have been omitted. It is therefore necessary for members to retain their original copies until at least a third edition is published.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia. — ADELAIDE. — 12th May. Electricity Trust of South Australia. Boilers for Mount Gambier power station. (E.S.B. 8124/54. Ten/8779.)*

Coventry.—7th May. Corporation. Electrical work at wholesale market, Barras Heath. (See this issue.)

Dublin.—15th April. Board of Assistance. Revision of the existing electrical system at St. Kevin's Hospital and electrical installation for an extension to an existing building. N. Mathews, consulting engineer, 42, Fitzwilliam Place.

Durham.—17th April. County Council. Electrical installations in 14 police constables' and two senior officers' houses at Broomside Lane, Belmont. County architect, Court Lane, Durham.

Goole. — 26th April. Corporation. Street lighting equipment. (See this issue.)

India. — NEW DELHI. — 22nd April. Directorate-General of Supplies & Disposals. Horizontal electric furnace. (E.S.B. 8451/54. Ten/8804.)*

Iraq.—BAGDAD.—15th June. Development Board. Power stations at Mosul (15,000 kW) and Kirkuk (10,000 kW) for cement works. (E.S.B. 5379/54. Ten/8785.)*

10th May. Directorate General of Municipalities. One 100 kW d.c. generating set for Kifri. 13th May. Two 50 kW alternator sets at Saadiya and one 50 kW and one 25 kW alternator sets at Mahaweel. (E.S.B. 8223/54. Ten/8790.)*

Market Rasen.—26th April. U.D.C. Pumping machinery complete with electric motor and automatic switchgear at Middle Rasen. Silcock & Simpson, consulting engineers, 10, Park Row, Leeds, 1.

New Zealand. — WELLINGTON. — 27th April. Post & Telegraph Department. 600 valves. (E.S.B. 8405/54. Ten/8800.)*

Pakistan. — KARACHI. — 21st April. Posts & Telegraphs Directorate. Insulators, wires and wiring materials. (E.S.B. 8056/54. Ten/8789.)*

South Africa.—JOHANNESBURG.—22nd April. South African Railways. Electrically-driven pumping plants. (E.S.B. 8538/54. Ten/8807; and E.S.B. 8540/54. Ten/8822.)*

CAPE TOWN.—23rd April. Provincial Administration, Cape of Good Hope. X-ray equipment. (E.S.B. 8216/54. Ten/8787.)* Diathermy apparatus. (E.S.B. 8267/54. Ten/8792.)*

Stourbridge. — 24th May. Main Drainage Board. Electrically and diesel driven vertical spindle centrifugal pumps for the Enville Street pumping station. John H. Haiste & Partners, Norwich Union Chambers, Clarence Street, Gloucester.

United States.—DENVER.—15th April. Bureau of Reclamation. Instrument transformers for the Maricopa substation, Davis Dam project, Arizona–Nevada. (E.S.B. 7850/54. Ten/8773.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Bradford.—City Council. Installation of electricity at Wellington Road Infants' and Junior School (£1,220).—J. Carter & Son (Bradford). Electrical installation in the Undercliffe Infants' School (£805).—John Wilkinson & Sons (Greengates).

Croydon.—Water Committee. Electric control gear for reconstructed Surrey Street pumping station (£3,279).—Igranic Electric Co.

Highways & Street Services Committee. Renovation of 240 lanterns, Purley Way (£1,316) and renewal of wiring (£2,224).—South Eastern Electricity Board.

Hendon. — Highways Committee. Recommended. Improved street lighting in Hendon Way and Watford Way between North Circular Road and Aerodrome Road (£1,881 for concrete columns and £2,025 for electrical equipment).—Revo Electric Co.

Ipswich.—East Anglian Regional Hospital Board. Recommended. Electrical services for block "D" of Borough General Hospital, Ipswich (£4,429).—Mann, Egerton & Co.

London.—BERMONDSEY.—General Purposes Committee. Recommended. Improved lighting of Tower Bridge Road, Duke Street Hill, Tooley Street, Dockhead, Parkers Row, Jamaica Road and Lower Road, using G.E.C. lanterns and Concrete Utilities columns (£14,971).—Erecon.

POPLAR.—Contracts & Purchasing Committee. Recommended. Electrical installations and fittings in dwellings in the St. John's Parish area (£1,915).—Iverson Electrical. Installations and fittings in 20 houses, Tredegar Road (£633). — D.C. Engineering Co.

Newcastle-on-Tyne.—Regional Hospital Board. Installation of lifts at pathological institute and regional blood transfusion centre at the General Hospital (£10,411).—Evans Lifts.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Andover.—Licensed premises, Weyhill Road; Strong & Co. (of Romsey), Ltd., brewers, Romsey, Hants.

Atherton.—Extensions to Formby Hall; J. C. Prestwich & Sons, architects, Bradshawgate Chambers, Leigh, Lancs.

Bath.—Rebuilding Assembly Rooms; National Trust, 42, Queen Anne's Gate, London, S.W.1.

Bexhill.—Furniture depository; T. Mepham & Sons, Ltd., Town Hall Square.

Blaydon (Co. Durham).—Factory, Shibdon, for Churchill-Redman, Ltd., machine tool makers, Scotswood, Newcastle-on-Tyne.

Brentford and Chiswick.—Flats (33) and shops (21), Albany Road; W. F. J. Church, town clerk, Town Hall, Chiswick, W.4.

Brierley Hill.—Houses (135), Forge Lane site; J. E. Garratt & Co., Ltd., High Street, Pensett, Brierley Hill.

Brighton.—Factory in the Lower Bevendean light industrial area for Brighton Sheet Metal Works, Ltd., 43, Devonshire Place, Brighton, 1.

"Cornish Unit" flats (126), site 5B, north of Chelwood Close and Cuckmere Way, Hollingbury estate; James Miller & Partners, Ltd., 7, Suffolk Street, London, S.W.1.

Bromley.—Flats (78), Park site; E. W. & S. Rumph (Builders), Ltd., 9, Widmore Road.

Darlaston. — Building combining church, vicarage and church hall (£48,000) for the Owen Organization; Lavender, Twentyman & Percy, architects, Waterloo Chambers, Waterloo Road, Wolverhampton.

Darlington.—Houses (30) at Aycliffe, Middleton St. George and Whessoe, for R.D.C.; Hutton & Hutton, architects, 24, Southend Avenue.

Doncaster.—Proposed boys' technical school (£140,000); borough architect.

Dover.—Offices, hall, living quarters, etc., Shargate Street/Adrian Street site; National Union of Seamen, 11, Shakespeare Road.

Durham.—New infants' school, Billingham North (£36,000); J. W. Henderson & Co., builders, Church Road, Stockton-on-Tees.

Ealing. — Dwellings (172), Northolt Park estate; borough engineer.

Ellesmere Port.—Houses (96), North Whitby estate; U.D.C. surveyor, Queen Street Offices.

Gillingham. — Great Line County Secondary School; borough education architect.

Harrogate. — Factory at Hookstone Avenue for Robert Hirst & Co., Ltd.; H. Webster, architect, 6, Vernon Street, Leeds, 2.

Haverhill.—Two shops and eight flats, Parkway estate; Holmes Bros., builders, New Road, Saffron Walden.

Hereford.—Annexe to Walney House Home; W. Usher, county architect, Bath Street, Hereford.

Jarrow-on-Tyne.—Additions to works for Shell-Mex and B.P., Ltd., London, including maintenance building, office and canteen.

Leicester. — Occupational centre, Western Park (estimated cost £40,820); city architect.

Leyton. — Reconstruction of Cathall Road Baths; borough surveyor, Town Hall, E.10.

Liverpool.—New bank and offices at 99, Bold Street, for Barclays Bank, Ltd.; Edmund Kirby & Sons, architects, 5, Cook Street, Liverpool.

London.—CITY.—Office block, Watling Street and Cannon Street; Humphreys, Ltd., Knightsbridge, S.W.7.

HOLBORN.—Welsh Presbyterian Church, Holborn Viaduct; Albert J. Thomas, architect, 31a, Sloane Street, S.W.1.

SYDENHAM.—New buildings (£320,000) for County Secondary School, Dartmouth Road; Lavender McMillan, Ltd., builders, Cheam Common Road, Worcester Park.

Londonderry.—New 300-bed general hospital, in stages, for Northern Ireland Hospitals Authority; secretary to the Authority, 44/46, Queen Street, Belfast.

Lowestoft.—Pavilion on South Pier; Skipper & Partners, architects, 66, Prince of Wales Road, Norwich.

Manchester.—Extensive factory premises in the Platt Bridge area; Co-operative Wholesale Society, 1, Balloon Street, 4.

Margam (Port Talbot).—Hotel; Evan Evans Bevan, Ltd., brewers, Cadoxton House, Neath, Glam.

Middlesbrough.—Proposed Longlands County College (£167,000); G. Fordy & Son, builders, Boathouse Lane, Stockton-on-Tees.

Morpeth.—Hotel at Stobhill for Deuchar & Co., Ltd.; Stanley Miller, Ltd., 17, North Street, Newcastle-on-Tyne.

Shopping parade (£20,000); R. Carse & Sons, Oldgate, Morpeth.

Northants.—New buildings at St. Crispin Hospital, Duston; J. M. Sheppard & Partners, architects, 38, Bedford Place, London, W.C.1.

Oldbury.—Works extensions at Narrow Lane, Cakemore, for Firth-Vickers Stainless Steels, Ltd.

Oswestry.—Houses (74), Middleton Road; T. Warrington & Sons, Ltd., 82, Station Road, Ellesmere Port, Ches.

Reading. — Factory in Basingstoke Road; Hansen Laboratory, Ltd., 96, Queens Road.

Robertsbridge (Sussex).—Houses (56), Bishops Lane; A. H. Neave, architect, 38, Mount Street, Battle.

Rochdale.—Dwellings (140); borough surveyor.

Rochester.—Dwellings (344), Temple Farm estate; borough surveyor.

Spalding.—Development of Windsor estate; council's architect.

Stockport.—Children's home at Alvaney Crescent, Bridge Hall estate; borough engineer.

New police headquarters; G. Bullimore, architect, Lloyds Bank Chambers, Great Underbank.

Stretford.—Office building for E. Boydell & Co., Ltd., Elsinore Road, Trafford Park; C. S. Allott & Son, consulting engineers, 1, North Parade, Manchester.

Swansea.—Showrooms and offices, Kingsway; Currys, Ltd., 75, Uxbridge Road, London, W.5.

Tottenham. — Works, White Hart Lane; Thoran Engineering Co., Ltd., 1a, Kimberley Gardens, N.4.

Torquay. — Houses (50), Watcombe Park estate; C. W. Baschwitz, Watcombe Hall.

Factory, Newton Road; British Van Heusen Co., Ltd., 8, Haymarket, London, S.W.1.

Tynemouth.—Lynn Road R.C. Secondary School and Argyle Terrace Technical School (to be erected in 1955–56); borough engineer, 16, Northumberland Square, North Shields.

Winslow.—Fire station; county architect, County Hall, Aylesbury.

Wigan.—Hotel (£60,000); Peter Walker Cain Brewery, Ltd., Warrington.

Six shops, Market Street; borough engineer.

Winton.—Factory, Wallisdown Road; Good Listening, Ltd., Exeter Lodge, Exeter Road, Bournemouth.

Worksop.—Erection of Kilton Hill C.P. School; J. E. Smith (Worksop), Ltd.

Shops, Kilton Hill estate; J. Haslam & Sons, 5, Newcastle Avenue.

York.—Extension to provide twin operating theatre suite and clinic at County Hospital; F. Rowntree & Son, architects, 120, The Mount.

NEXT WEEK'S EVENTS

Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Monday, 12th April

BIRMINGHAM.—Birmingham Electric Club. "Newer Insulating Materials," by Dr. G. Tolley.

IPSWICH.—Electric House, 6.30 p.m. Ipswich and District Electrical Association. Local industries night. "Air Compressors produced at Ranelagh Works," by S. Goymour.

LEEDS.—Town Hall, 7 p.m. I.E.E. North Midland Centre. Faraday Lecture: "Electro-Heat and Prosperity," by O. W. Humphreys.

LEICESTER. — Electricity Offices, Charles Street, 7 p.m. Leicester Electrical Society. "Application of Magnetic Devices," by J. E. Apted.

LONDON.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers. Informal meeting. Discussion on "Safety Measures for Radio and Television Equipment," opened by E. P. Wethey.

NEWCASTLE - UPON - TYNE.—Royal Station Hotel, 6.15 p.m. I.E.E. North-Eastern Centre. Annual general meeting and conversazione.

King's College, 6.30 p.m. Institute of Fuel, North-Eastern Section. "Atomic Energy," by R. V. Moore.

SHEFFIELD.—The University, Western Bank, 6.30 p.m. I.E.S. Sheffield Centre. Address by the President, followed by annual general meeting.

Tuesday, 13th April

BELFAST. — Presbyterian Hostel, Howard Street, 6.15 p.m. I.E.E. Northern Ireland Centre. "Special Effects for Television Studio Productions," by A. M. Spooner and T. Worswick.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Utilization Group. "Fluorescent Discharge-Tube Circuits and Operating Problems," by J. Cates.

LONDON.—Savoy Place, 6.30 p.m. I.E.E. London Students' Section. Address by the President, H. Bishop.

Holborn Restaurant, 12.30 for 1 p.m. Electrical Industries Club. Luncheon. Address by E. Hartley Leather, M.P.

London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1, 6 p.m. Illuminating Engineering Society. "Illuminants for Colour Reproduction and Printing," by H. M. Cartwright.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Supply Group. "Some Design Features of the Semi-Outdoor Power Station at Ince," by F. H. S. Brown.

NEWPORT.—Flying Services Club, 28, High Street, 7 p.m. Newport and District Electric Club. "C.A.P. Cables," by H. S. Pilling.

Wednesday, 14th April

BIRMINGHAM.—James Watt Institute, 6.30 p.m. I.E.E. South Midland Centre Students' Section. "The Professional Engineer in Management," by D. H. Bramley. (Joint meeting with the Graduates' and Students' Sections of I.C.E. and I.Mech.E.).

BLACKBURN.—N.W.E.B., Darwen Street, 7.15 p.m. I.E.E. North Lancashire Sub-Centre. "Electricity in the Wool Textile Industry," by A. J. Francis and T. H. Carr.

LONDON.—Grosvenor House, Park Lane, 12.30 for 1 p.m. British Electrical Development Association. Annual luncheon, followed at 3 p.m. by the annual general meeting.

Waterloo Bridge House, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. "T.V. Receiving Aerials," by G. L. Stephens.

NEWCASTLE-UPON-TYNE. — Neville Hall, Westgate Road, 6 p.m. British Institution of Radio Engineers, North-Eastern Section. "Electroencephalography," by Prof. Alexander Kennedy and J. W. Osselton.

NOTTINGHAM.—Gas Board Showrooms, Parliament Street, 7 p.m. Incorporated Plant Engineers, East Midlands Branch. Members' papers.

SHEFFIELD.—City Hall, 7.30 p.m. I.E.E. Sheffield Sub-Centre. Faraday Lecture: "Electro-Heat and Prosperity," by O. W. Humphreys.

Thursday, 15th April

BLACKBURN.—Grosvenor Hotel, Lord Street, 7.30 p.m. Incorporated Plant Engineers, Blackburn Branch. "Thermal Insulation in the Medium Temperature Range," by C. Jolley.

BRISTOL.—Electricity House. I.E.E. Bristol Students' Section. Annual general meeting followed by film show.

GLOUCESTER.—2, St. Aldate Street, 6.30 p.m. I.E.S. Gloucester and Cheltenham Centre. Annual general meeting.

LONDON. — Connaught Rooms. Diesel Engine Users' Association. Annual luncheon.

"Machine Shop Magazine"

To increase its already wide coverage of engineering production matters, *Machine Shop Magazine* has enlarged its editorial content by a third. A new feature starting in the April issue (published on the 15th) will be the inclusion of coloured data cards giving tabulated information and graphs not readily available elsewhere; the cards will be perforated so that they can be detached for filing.